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THE DEVELOPMENT OF CHILDREN'S ABILITY TO RECOGNIZE FACIAL EMOTION

Presented by

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for the Degree of Master of Philosophy

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Abstract

This study investigated the development among 3½ to 11 year old children of the ability to recognize six common emotions (Happiness, Disgust, Sadness, Anger, Surprise and Fear), using a procedure which employed six standard photographs (of male and female faces and of parts of the female face) accompanied by illustrative short stories. Additionally, children's ability to match photographs on the basis of emotion expression was examined and compared with performance on the recognition task. The relationship between recognition of facial emotion and age, social class, sex, popularity with peers, extraversion and neuroticism, birth order and the presence or absence of siblings was also investigated.

Individual testing of children aged 3½ to 6 was employed, and a procedure was developed for group testing of older children.

The results confirmed that accuracy of recognition of emotion increases with age. Social class differences emerged on recognition of emotion in the male and female face, and in parts of the face (excluding the nose). Only in recognition of emotion in eyes did girls perform more accurately than boys. Accuracy of recognition correlated significantly with popularity with peers except in judgments of emotion in the eyes. Extraversion was significantly correlated with accuracy of recognition of emotion in the female face and eyes. Presence or absence of siblings was not significantly related to emotion recognition, but later born children recognized emotion in noses more accurately than first born children.

It was also demonstrated that children's ability to match emotion expressions emerges before their ability to recognize the expressions. Analysis of errors showed that the pattern of errors made in emotion recognition was similar to that found in emotion recognition studies with adults. The errors in emotion matching reflected those

found in recognition. However, there were also common confusions in matching which were found in emotion recognition by the younger children, but not among older children in the present study, or in the adult studies.

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CHAPTER I: EMOTIONS AND FACIAL EXPRESSION

INTRODUCTION

Both psychologists and philosophers have attempted to explain the variety of 'affective states' the human being has reported that he experiences, and that he has been observed experiencing. The possibility of a continuum existing from 'affective states' observed in the animal world to those of the human world has also been examined. Although many theories have been proposed and many experiments have been carried out, there is still no theory - philosophical or psychological - which answers all the questions asked of it nor which can command absolute support. In the field of philosophy Descartes had stated:

> "There is nothing in which the defective nature of the sciences which we have received from the ancients appears more clearly than in what they have written about the passions; ..."[1]

In 1872 Darwin's The Expression of Emotion in Man and Animals was published, but despite Darwin's reputation as a scientist it had little influence on the scientific community. Ekman (1973, p. 2) reports that from Darwin's time until the 1960s there was no progress in the study of facial expression of primates. He suggests five reasons why Darwin's work was ignored: (1) his use of anthropomorphic terms; (2) his reliance on anecdotal rather than systematic data; (3) his emphasis of the innate basis of at least some emotional expressions; (4) his adoption of the view that learned characteristics could be inherited; and (5) his adherence to the deductive method.

The failure of psychology to develop a comprehensive theory of emotions has been pointed out by Izard (1972):

> "The area of emotional experience and behaviour is one of the most confused and ill-defined in psychology."[2]

Perhaps to look for an all-embracing psychological theory of emotion is too much to ask of the field in its present state of

development. The methodological problems associated with the development of this area were (and remain) complex, but the first question which theory set out to answer was: what are emotions?

In answer to this question two main strands can be traced. One strand - the typological approach - appeared in terms of attempts to explain psychologically and physiologically what an emotion was, and proposing that emotions were separate and discrete states. The typological approach embraces perspectives as diverse as the behavioural theory of Skinner (1938, 1953)[3] and the attitude theory of Bull (1968).

The second strand - the dimensional approach - attempted to define emotion in terms of a point in a space upon which was superimposed a number of dimensions which the theorists (e.g. Schlosberg, 1952) considered to be the key to mapping emotional behaviour. The dimensions were often those applied to all behaviour thus denying that emotional behaviour had a special quality.

If dimensional theorists had merely been seeking to identify dimensions underlying the discrete states proposed by typological theorists, then there would not now be two distinct approaches. However, the dimensional theorists' denial that there were discrete states such as sadness or happiness, and their insistence that emotions were not qualitatively different from all other behaviour, resulted in a split between the approaches.

This chapter will briefly outline theories and research within the typological and dimensional approaches which particularly stress the role of facial expressions. (A comprehensive review of theories of emotion may be found in Strongman, 1978.) The outline presented will indicate the diverse and often conflicting explanations of the relationship between facial expression and emotion. However, it will be shown that research has established that adults can make judgments

about emotions on the basis of facial expression both in terms of dimensions (e.g. Schlosberg, 1952) and discrete categories (e.g. Izard, 1971). It is unfortunate that no researcher has obtained judgments relating to both discrete states and dimensions from the same population of subjects, using a single unbiased set of stimulus photographs. Such a study would yield much information - e.g. whether judgments on dimensions are more difficult than judgments by categories for certain individuals or groups.

THE TYPOLOGICAL APPROACH

Classical Theorists

William James (1910)[4] proposed that when a sense organ is stimulated, afferent impulses pass through the cortex and the object is perceived. The muscles and the viscera then receive reflex currents which produce complex changes, the organs thus disturbed 'report back' to the brain via further afferent impulses, and the emotion is now 'felt' as an emotion. James was the first psychologist to propose that distinctions could be drawn between the emotions on the basis of facial and postural activity, although other writers have often overlooked his proposal. Izard (1971, p. 107) suggests this may be because James's later work stressed the importance of visceral and glandular responses.

James's proposal that the bodily changes, once perceived, are the emotion was challenged by Magda Arnold (1960). Arnold pointed out that the theory does not explain how perception of the 'exciting fact' can produce this proposed bodily change and hence the felt emotion. She also pointed out that there is no provision in the theory for distinguishing between long or short lasting emotions. And, of course, while James would argue that emotion cannot be repressed Arnold reports this is widely accepted in psychoanalytic practice.

Often the theories of James and Lange (1885)[5] are combined and

classified as the 'James-Lange theory', but Wenger (1950) considered that there was one fundamental difference between the two theories which made the 'James-Lange theory' label meaningless; while James argued it was awareness of bodily changes resulting from the perception of the exciting fact which was emotion, Lange argued that emotion was the bodily change.

F.H. Allport (1924)[6] attempted to improve on James's theory, since he considered that it lacked an indication of how the emotions and their attendant bodily states were differentiated. He proposed that the feedback from facial and postural striate muscles made the organism aware of the emotion being experienced. The different combinations of muscles associated with the different emotions provided the discrete facial expressions. He, too, recognized that fundamental emotions could combine to produce more complex emotional states.

In contrast to James, the theory of Cannon (1927)[7] (later supported by evidence from Bard [e.g. 1928][8] and designated the Cannon-Bard theory), proposed that sensory feedback is not necessary for emotional behaviour. This theory proposes that as incoming impulses from the exciting event are filtered through the hypothalamus the distinctive quality of the emotion is added and the impulses excite not only muscles and viscera, but also areas of the cortex where intellectual aspects are integrated. Thompson (1967), however, reports many researchers have criticised the proposal that the hypothalamus is the key to understanding emotion (e.g. Kulver and Bucy, 1937; Hebb, 1949; and Meyers, 1950).[9]

Behaviouristic Theories

Watson (1929) defined emotion as "an hereditary pattern reaction involving profound changes of the bodily mechanism as a whole, but particularly of the visceral and glandular systems".[10] Watson attempted to establish which stimuli would arouse emotion responses in newborn

infants - he attempted to arouse fear, rage and love, which he called x, y and z in infants to differentiate them from the mature adult emotions. However, Sherman (1927 and 1928) showed that when judges were not aware of the stimuli which had aroused the infant, they could not define which emotion was being shown. Later researchers have criticized these experiments since Watson did not establish that the stimuli would arouse the emotions intended. His use of infants only a few days old was also criticized, since it would not be expected that their emotional expressions would be clearly differentiated.

Tolman (1923) proposed that emotion was not the behaviour which a person exhibited, but was rather the readiness or drive for such behaviour. He argued that emotion could not be understood or defined in terms of the stimulus alone or the response alone - instead we must look for the relation between the stimulus and the response. The responses the organism makes are designed to affect or change the stimulus situation.

Skinner (1938 and 1953),[11] however, proposed that we deduce that a person is experiencing a certain emotion, not from any measure of internal biological processes, but from the way they behave (e.g. changes in rate of talking). Although he states that we may draw as many distinctions as we wish between separate emotions he does not propose how we make these distinctions, nor the criteria we use for deciding that one emotion is qualitatively different from another.

Attitude Theory

Unlike James, who proposed that feeling 'sorry' was a result of crying, Bull (1951) proposed that the attitude or readiness to cry mediated the emotion, and that crying removes the 'sorry' feeling. Bull's theory proposed that the preparatory attitude was both involuntary and instinctive, and was the end result of a tentative movement which, although not enough to trigger consummatory action, did

re-orientate the individual. In 1968 she described the predisposing neural pattern as a continuous underlying presence which exists "not only before the activated process but also during and after it". (Bull, 1968, p. 16).

Motivational Theory

Leeper (1948) considered emotions to be primarily motives because they arouse, sustain and direct activity, and was criticized by Hebb (1949) for broadening emotion to include all psychological processes because they almost all act to 'arouse, sustain and direct' behaviour.[12] Leeper did not distinguish between emotion, drive and cognition, but instead combined them to propose that emotion was the process underlying a happy expression or a frightened look. He proposed that emotion formed just part of a continuum of perceptual processes ranging from motivationally neutral to motivationally powerful perceptions. Leeper (1970) states: "Emotions, we might say, are the individual's perceptions or representations of what he regards as the most significant realities in his life." (p.151).

Tomkins (1962 and 1963) preferred the term 'affect' to 'emotion'. He considered the affect system to be the primary motivational system, with the drive system secondary - i.e. drives require amplification from the affects. Tomkins proposed that since facial muscles and nerves are capable of very rapid change, affect is primarily facial behaviour (and secondarily bodily behaviour - i.e. outer skeletal and inner visceral behaviour). We respond to these affects (either consciously or unconsciously) and learn to generate them from memory without the facial expression having to be present. He, too, argued that there were primary affects, and proposed that these were differentiated by changes in the density of neural firings or stimulation: the density could remain steady, increase or decrease. Tomkins argued that some triggers of emotion are unlearned, but that memory and analysis also come into play.

The Discrepancy Hypothesis - Hebb

Hebb (1949) suggested a dualistic approach - (1) integrative emotions, where there was a tendency to maintain or increase the original stimulating situations, and (2) disintegrative emotions, where the tendency was to decrease or get rid of the stimulus. Hebb (1949, p. 148) defined emotion as "the neural process that is inferred from and causes emotional behaviour with no reference to consciousness". According to Hebb too little discrepancy between expectation and experience will produce boredom, while too much will produce distress and severe disruption of cognitive processes. Pleasure is experienced when there is a moderate amount of discrepancy. Hebb does not ascribe a special role to facial expressions within his theory of emotion.

The Cognitive Element in Emotions - Schachter

Schachter (1959, 1964) suggests that emotions result from a general arousal state of the sympathetic nervous system, which may differ slightly depending on which emotion is being experienced. However this arousal state is not sufficient to result in an emotion being experienced - the individual must also use clues from the circumstances which caused the arousal. Schachter's subjects exhibited emotional behaviour similar to that of a 'stooge' - but detailed comparisons of the facial expressions were not carried out.

Emotions as Derivitives of Adaptive Biological Processes - Plutchik

Plutchik (1962) uses an analogy of 'colours mixing to produce new colours' to outline his theory. He proposes all emotions are constructed from eight pure primary emotions (based on eight basic behavioural patterns) - the emotions are arranged in a circle, those most alike adjacent, those most different opposite (in polar pairs). Perhaps the greatest flaw in his theory is that he does not convincingly explain how the emotions are based on the specific behaviours. Plutchik

has, however, demonstrated that emotions can be accurately identified from facial expression, and his theory does take into account intensity, as well as the relative positions of the polar pairs of emotions. Plutchik argues we can, for example, subjectively experience fear while behaviourally escaping, which has the function of protecting us. The subjective element of emotions, he proposes, can only be applied to humans.

Izard's Theory - An attempt to relate neural activity, facial-postural patterning and subjective experience

Izard (1971) drew together ideas from Arnold (1960), Gellhorn (1964, 1968), Gellhorn and Loofbourrow (1963), Pribam (1967, MacLean (1968) and Tomkins (1962)[13] to produce a comprehensive outline of emotion. He proposed that there were three levels of emotion - (1) the neural or electrochemical activity which in fundamental emotions follows innate structures, and in turn fires the muscles responsible for producing (2) facial, postural and locomotor musculature patterning and feedback from this to the brain, which in turn produces (3) the subjective experience. If the process is not inhibited or disturbed, and the facial pattern produced and fed back to the brain 'matches' the emotion originally 'fired' by the neural activity the organism has no difficulty in identifying the emotion. However, if facial feedback is delayed, then postural activity or information from other organs are the only cues the subject has, and the subjective experience may be delayed and less intense, and less readily identifiable. Izard proposes that as cognitive development progresses the child can use memory and imagination increasingly in his handling of the emotion process.

Izard proposed the fundamental emotions were Interest/Excitement, Enjoyment/Joy, Surprise/Startle, Distress/Anguish, Disgust/Contempt, Anger/Rage, Shame/Humiliation and Fear/Terror. He generated a set of stimulus photographs for his cross-cultural study of recognition of the fundamental emotions by presenting photographs for categorization by

groups of subjects, and rejecting any photograph not correctly categorized by 70% of them (Izard, 1971, p. 246). This method in itself illustrates that emotions can be accurately identified from facial portrayals. Izard's experiments with children will be discussed in Chapter II.

Thus theorists from many different perspectives have proposed that emotions are discrete states, and research has shown that adults can make accurate judgments about these discrete states from facial expressions (e.g. Izard, 1971; Ekman and Friesen, 1971). Studies where children have made similar judgments will be discussed in Chapter II.

THE DIMENSIONAL APPROACH

Although some theorists within the dimensional approach would deny that emotions exist as a distinct and separate process or state, others accept that an emotion can be defined as a point in a space mapped by their dimensions. Dimensional theorists argue that the same dimensions can be used to map all behaviour (including emotional behaviour).

Spencer[14] as early as 1890 had proposed a pleasantness/unpleasantness dimension, although he did equate emotion and sensation, calling them types of feeling. Emotion for Wundt (1896)[15] was simply a point on a three-dimensional space (pleasant/unpleasant, tension/relief, excitement/quiet). Combinations of these three elementary feelings produced the complex emotions.

Woodworth (1938)[16] re-examined responses given in Feleky's (1914) labelling of emotion expression experiment. He grouped all the responses which were synonyms and accuracy on surprise went up from 52% to 77%. Woodworth then went on to arrange the emotions so that those most often confused were together. The categories most likely to be confused were then placed adjacent to each other producing a six-point scale: love-happiness-mirth/surprise/fear-suffering/anger-determination/disgust/contempt.

Schlosberg (1952) found that although subjects very rarely confused the love-happiness-mirth group with disgust, they did confuse that group with contempt, which was at the other end of the scale, and he proposed that love and contempt should be adjacent. The resulting Woodworth-Schlosberg circle suggested two dimensions: pleasantness/unpleasantness and rejection/attention. In 1954 a third dimension was added: sleep/tension.[17] Although Schlosberg later described emotion as one end of a continuum of activation, he did not reject the idea of discrete emotion concepts - but pointed out their advantages for some research and practical purposes.

Abelson and Sermat (1962) attempted to ascertain if Schlosberg's method of asking subjects to rate photographs along pre-conceived dimensions was masking other dimensions which might be present. They found the pleasantness/unpleasantness and sleep/tension dimensions, and rejected the attention/rejection dimension as redundant. They also found three dimensions which were not readily interpretable. The photographs they used were taken with Schlosberg's dimensions as a guide, so they were not as varied and representative of all emotions as they should have been. Frijda and Philipszoon (1963) found four factors, the first of which was pleasantness/unpleasantness. The remaining factors were 'naturalness and submission v. artificiality and condensation', 'control of expression v. intensity of expression', and 'activity v. disinterest' (sic.).

Dittman (1972) has pointed out that in almost all the dimensional studies factor analysis is used, and since the purpose of factor analysis is to find dimensions, this dictates the form of the results. A similar criticism can, of course, be levelled at the typological studies. Dittman's analysis shows that in all the studies using factor analysis, three dimensions are the minimum required for mapping, and pleasantness/unpleasantness, activation level and interest/lack of interest are the dimensions most commonly identified.

However, as Izard points out, the main failure of the dimensional approach is that it lacks a theory which can generate testable hypotheses. Photographs have been rated on pre-selected scales, and the ratings used to generate the dimensions. It thus remains to be shown that the dimensions generated in this way are the same dimensions underlying the emotion of which the facial expression is just a part. While factor analysis gives the weighting of dimensions, it does not name them - thus Abelson and Sermat were unable to interpret three of the dimensions which were generated.

Dimensional theorists have not investigated whether children can rate photographs on the same dimensions as adults.

THE HIERARCHICAL MODEL - Frijda

Frijda (1970) proposed that emotions could be envisaged as discrete states - each state having attributes in common with all of the other states (e.g. intensity, degree of attentional activity involved), in addition to attributes which were specific to that emotion or group of emotions. Alternatively emotion could be viewed as an n-dimensional space which in certain regions had further differentiations. Frijda proposed that to recognize facial emotions involved making a prediction as to how the other person viewed the situation, anticipation of his likely behaviour and making inferences about his internal state. He proposed that recognition of facial emotion proceeds by making progressively finer differentiations (the first one being whether the face is pleasant or unpleasant). Frijda proposes that this progression of judgment, first on dimensions, then in general terms, and finally with reference to specific situational cues, should be reflected in the findings of emotion recognition experiments. However, he considers that we cannot infer dimensions found in recognition experiments are identical to dimensions of emotions.

CONCLUSION

Theorists from many different perspectives have thus attempted to explain what emotion is, and the role of facial expression. The dimensional approach denies the existence of discrete emotion states, and research by dimensional theorists shows that facial expressions of emotion can be classified in terms of dimensions (e.g. Schlosberg, 1952). But typological theorists (e.g. Frois-Wittmann, 1930; Izard, 1971) have also convincingly shown that people can judge what emotion is being experienced on the basis of photographs of facial expression.

The dimensional approach lacks the richness and diversity of theory and experimentation of the typological approach. A more fruitful search for testable hypotheses for the dimensional approach may lie within typological theory - i.e. that there are, as Frijda (1970) suggests, dimensions underlying discrete emotion states. This sort of 'model' seems to be the kind most likely to hold the key to understanding emotions. Just as we accept that we could describe facial behaviour in terms of the contraction of certain muscles, or more broadly in terms of phrases such as 'eyes wide open' - and, of course, in terms of concepts such as 'happy' - then surely we must accept that the emotion of 'happiness' can also be described at different levels - e.g. physiologically, neurologically or completely subjectively by self report. If we look at happiness in relation to other emotions, then, while accepting they are separate and distinguishable, it is logical to look for an underlying structure - just as, in a physical sense, the muscles of the face provide the underlying structure for facial portrayal of the emotions.

Theorists within both approaches recognize the importance of facial expressions in emotion. Neither approach, however, puts forward a convincing developmental theory of emotion expression and recognition which fits comfortably within a comprehensive model.

CHAPTER II: THE DEVELOPMENT OF CHILDREN'S ABILITY TO RECOGNIZE FACIAL EMOTION

INTRODUCTION

When growth of portrayal and recognition of emotions in children are considered, the deficiencies of emotion theory become increasingly obvious. Strongman (1978) in his analysis of the psychology of emotion stated:

> "Overall, the field of emotional development is confused. It is unsystematized and, indeed, it is difficult to impose any system on it." (p. 180-1).

Strongman reviews theories of emotion, discusses the physiology and phenomenology of emotion, the relationship of cognition and emotion, and emotional behaviour. However, he confines his review of the development of emotion in children to the development of emotion expression, and his discussion of recognition of emotion is confined to studies with adults.

Although some data on when children become capable of exhibiting or recognizing emotions have been collected, we can as yet only speculate as to how they develop these abilities. Studies of recognition of facial emotion in children have not included analysis of the types of recognition error they make (i.e. what emotions are confused, and what emotions, if any, are never confused) or whether specific types of error are related to individual differences (including age), the relationship between the emotions themselves, or some other factor. The adult's ability to recognize emotion from just part of the face has been

investigated (e.g. Coleman, 1949; Plutchik, 1962), but the role of different areas of the face in assisting children to make judgments about the emotion being portrayed has not been examined.

Charlesworth and Kreutzer (1973) produced a comprehensive review of research into child portrayal and recognition of emotion up to 1972. Their review examines the major studies undertaken with normal children from birth up to 16 years of age, studies undertaken with blind

children and with children who experienced severe social deprivation. Their main criticisms of research on recognition of emotion in children was that it lacked the richness of approach and analysis which had been applied to adult studies. Since their review was written, research into infants' and children's perceptions of faces has become more imaginative. For example, Dirks and Gibson (1977) have established that 5-month-old infants do regard photographs as representations of real people, and Hess and Pick (1974) have attempted to gauge the relative importance of the eye and mouth regions of the face in supplying information. Two criticisms made by Charlesworth and Kreutzer have not been met however: types of recognition error made by children have not been analysed, and no attempt has been made to gauge the relative importance of cues from the situational context and facial expression in making judgments about emotions in real life situations. Analysis of types of recognition error would indicate how the ability to recognize facial emotion develops as well as indicating something about the nature of emotions. Are broad distinctions first learned (between pleasant and unpleasant) with finer distinctions then being made between, for example, surprise and fear? If such learning patterns were found, this would suggest that perhaps Frijda (1970) was correct in the model he put forward. Would, for example, some emotions be confused consistently? If so, can the confusions be explained in terms of any model of emotion (e.g. the Woodworth-Schlosberg circle)?

Charlesworth and Kreutzer conclude that on the basis of the results they review it is not possible to state whether recognition of facial emotion is learned or innate. They argue that the methodology employed - often requiring labelling or at least verbal comprehension - has resulted in artificially low accuracy rates being obtained with very young children. Researchers have obtained conflicting results - in the earliest study Gates (1923) ranks the order of difficulty of

recognition of emotion as: laughter, pain, anger, fear, surprise and scorn, whereas Izard (1971) ranks them: anger, enjoyment, fear, surprise, distress, disgust, shame, interest and contempt. It is only possible to state, from reviewing all the results to date, that 'happiness' appears to be the first emotion reliably recognized by children. (See Table II.1).

Since development of recognition of emotion is part of the general development of the infant, this chapter will first summarize how some major theories of development would view the development of recognition of facial emotion. Research into infant perception of faces will then be briefly examined, since perception of facial expression is closely related to perception of the entire face and it is useful to consider the results of some emotion recognition experiments in the context of findings relating to perception of faces. Research into recognition of facial emotion in infants and children will then be reviewed and, where possible, results will be related to theories of emotion and development.

SOME THEORETICAL EXPLANATIONS OF THE DEVELOPMENT OF RECOGNITION OF FACIAL EMOTION

There are many, varied, explanations of how the child begins to perceive and learn about his physical and social environment. This section will outline how some major perspectives would view the development of recognition of facial emotion, and the failure of any perspective to supply a comprehensive explanation will be discussed.

Social Learning Theorists (SLT) (e.g. Sears, 1972; Bandura, 1965) propose that the child learns about his environment primarily through reinforcement of behaviour, and it is possible to imagine instances where a child would exhibit an appropriate response to emotional behaviour and be rewarded. SLT in its early form could not explain novel behaviour, and concepts such as 'imitation' and 'identification' were introduced. The concept of 'imitation' generated much discussion

Table II.1: Rank order of difficulty of recognition of facial emotion in experiments with children

Stafferi & Bassett (1970)	Gitter, Mostofsky & Quincy (1970)	Izard (1971)	Odom & Lemond (1972)	Gates (1923) & Kellog & Eagleson (1931)	Savitzy & Izard (1970)*
happy	happiness	anger	joy	laughter	anger
afraid	pain	enjoyment	surprise	pain	joy
worried	anger	fear	anger	anger	fear
pain	surprise	surprise	distress	fear	distress
surprise		distress	shame	surprise	
pleased		disgust	disgust	scorn	
puzzled		shame	fear		
angry		interest	interest		
		contempt			

* In this study rank represents the order in which children began pairing photographs on the basis of the emotion shown.

and criticism. The primary criticism was that it was simply a label applied to a range of phenomena which did nothing to explain how the phenomena were generated, nor their nature. The results of many of the experiments designed to highlight the nature of imitation proved impossible to explain in terms of the basic social learning theory hypotheses (e.g. Bandura and Walters, 1963).

In SLT the relationship of the child with an actual or symbolic model is the key to understanding imitation of behaviour. However, within SLT there is disagreement as to the nature of the relationship between model and child. If, for example, we consider a child imitating the mother's smile in social situations, then Bandura (1965) would argue that it is because the child has seen the mother being rewarded for such behaviour; Mowrer (1950) would propose that the child is rewarding himself by being like a loved model; and Miller and Dollard (1941) would state that imitation occurs because the mother has reinforced the child for such behaviour in the past. SLT does not take account of genetically controlled mechanisms or personality factors. It cannot explain phenomena such as insight or skill acquisition - so alone it cannot provide a convincing developmental model. SLT could not explain how, for example, a child could recognize disgust on a face not previously seen - i.e. how a child can differentiate between the permanent features of an unknown face and the expression portrayed.

Among cognitive theorists there are two main perspectives: (1) that information from the environment is not restructured before it is processed and (2) that information from the environment is actively restructured before processing. Theorists who propose that incoming information is not restructured (e.g. E.J. Gibson, 1969; J.J. Gibson, 1963, 1966) propose differentiation between stimuli and patterns is the key to learning and cognitive representations of the

distinctive features are stored. Increased differentiation occurs, Gibson argues, because the individual becomes sensitive to more and more variables in the stimulus. This theory reflects a similar model to that of Frijda (1970), who proposed that it is by making increasingly finer distinctions that adults distinguish between emotion expressions. Theorists such as the Gibsons reject the idea that there is a schema which is stored and refined with increasing experience, and against which incoming information is compared. However, it is difficult to hypothesize how a child could identify the expression on a stranger's face without some restructuring of the incoming information taking place. Would, for example, all the information be processed first to establish identity and then expression, or would there be a common process first with separation of processing for identification from that for expression at some point? Feature extraction models proposed by information processing theory (e.g. Holloway, 1974) require re-synthesizing to occur after feature analysis. E.J. Gibson (1967) reports: "Development seems to proceed from simple contours to differentiated structures to structured relations or patterns to unique patterns of individual faces, and finally to higher order properties invariant over different individual faces." (p. 347). However, she does not explain how the processing of these structures, patterns and properties occurs and how the child 'makes sense' of the processed information.

Walk (1978) suggests that the Gibsons's theory supplies a valuable focus on the stimulus which "might be lost if too much stress were allowed on the internal structure and plans related to perception". (p. 269). However, without such analysis and explanation of the 'internal structure' it is difficult to hypothesize exactly what the Gibsons mean by differentiation, and because of the multiplicity of meanings of 'differentiation' Walk enters a plea for someone to define a better term.

The passive model is rejected by other cognitive theorists (e.g. Baldwin, 1971) who propose that the child constructs cognitive representations of his environment through the processes of contiguity, generalization, reinforcement and repetition. These theorists admit that early learning thus occurs more or less in S-R terms, but that later these same processes operate in a more differentiated and precise way. The infant is attempting to code information from the environment - including the interrelationships between various aspects. The ability to understand the interrelationships between the facial expressions, the underlying emotions and the social behaviour surrounding expressions of emotion is obviously important if the child is to learn to interact successfully.

Kohlberg (1971), who adopts a cognitive-developmental approach, proposes that it is transformation of cognitive structure which explains development and that these transformations cannot be explained by contiguity, repetition, etc. Unlike Baldwin, who proposed that the information lodged in the stimulus was of paramount importance in the construction of cognitive representations, Kohlberg suggested an interaction between the structure of the organism and the structure of the environment. The construction of a cognitive representation is not therefore seen as a passive connecting of events through external reinforcement, but as an active process.

This interaction, Kohlberg argues, gives rise to the cognitive stages as outlined by Piaget. The critical features of the stages are that each stage denotes a different qualitative change in modes of thinking, the stages follow in invariant sequence, each stage represents a mode of thinking which is applied generally to the environment, and the higher stages involve a reintegration of previous stages. While the cognitive theory of Baldwin can explain recognition of facial emotion, it is the cognitive-developmental theory of Piaget and Kohlberg which

most fully explains the shift from egocentric thinking and the development of empathy, which is a further stage in the process.

Language plays a vital part in helping the young child understand and deal with his physical and social environment. How verbal ability is acquired has been the subject of much debate. Many theories have been propounded. Mediational theorists such as the Kendlers (1962)[19], proposed that verbal learning occurred by lengthy S-R chains being formed by past associations, and Vygotsky (1962)[20] considered that not only is the individual acted upon by his environment, but he in turn acts on the environment.

Bernstein (1973) argued that there was a class difference in the 'codes' mothers used to communicate with their children. The 'restricted code' used by working-class mothers, he argued, resulted in working-class children being less able to handle 'abstract' ideas than middle-class children, whose mothers used an 'elaborate code' which could be used to express abstract ideas. The view that the linguistic code an individual has available to him has important implications for how the individual can think is also supported by language theorists such as Whorf (1940).[21] The role of language codes in facilitating or hindering both recognition and understanding of emotions (and the child's ability to communicate such recognition and understanding to the experimenter) remains uninvestigated.

However, Schmidt and Hore (1970) report that high socio-economic status (SES) mothers engaged in more mutual glances with their pre-school children, while engaged in a story task, than did low SES mother/child pairs. The high SES mothers had been expected to use non-verbal communication less, since they had a more elaborate verbal code at their disposal. If high SES mothers generally do spend more time looking at their children, and reciprocate more of their glances, it is reasonable to hypothesize that such non-verbal communication presents ideal opportunities for the child to learn about facial expressions.

It is not possible to find a comprehensive explanation of the development of recognition of emotion within any single theory. Consideration of research findings to date suggests the process of recognition of facial emotion can be broken down into the following 'common sense' stages:

1. the ability to recognize that facial expressions are different (for this to occur it is only necessary that one expression be recognized and understood - though gradually the number understood and recognized increases);

2. the ability to apply appropriate verbal labels (Izard, 1971, has shown that a child may be able to recognize an emotion two years before he can correctly label it);

3. the ability to act appropriately on the basis of the judgment made.

Any attempt to explain these stages in terms of the theoretical perspectives outlined above makes it apparent that for each stage several explanations can be applied. Given the small amount of research which has been undertaken, and thus our limited understanding of the growth of recognition of facial emotion, it is not surprising that different theoretical explanations can be applied to the general characteristics of the process which have been identified to date.

The process of discrimination between facial expressions could, for example, be explained in terms of reinforcement (which is how the social learning theorists, and cognitive theorists such as Baldwin, propose early learning occurs) - i.e. the infant has a pleasurable experience and associates this with the 'happy' expression of the adult present at the time. But cognitive-developmental theory can also put forward an 'explanation' - that cognitive representations of facial expressions are developed and refined with increasing experience and cognitive development. Feature extraction models, template matching models, and scene analysis can supply explanations of how information from the environment is encoded and analysed.

However, recognition of facial expression does not automatically endow a child with the ability to act appropriately in social situations, nor is empathy required for appropriate behaviour to occur. Techniques such as role-playing and reinforcement of appropriate behaviour have been used to teach psychiatric patients appropriate social skills, however it remains to be shown whether it is by these sorts of mechanisms that children learn social skills. Acquisition of a social skill does not ensure that the behaviour will be 'run off' at the appropriate time. For example S-R explanations of learning of social skills ignore the fact that personality factors, or even physical restraints, may prevent an appropriate social response. Cognitive-developmental theory provides a convincing model of the development of empathy - i.e. a gradual shift from egocentricity to empathetic understanding of the feelings of others and appropriate social response.

Thus it is not possible to explain the development of recognition of facial emotion in terms of any perspective to the total exclusion of all others. This is not surprising for two reasons: (1) the small amount of research done to date into development of emotion recognition varies considerably in important respects - e.g. emotions examined, use of posed/unposed photographs etc. (See Tables II.2 and II.3.). Direct comparison of results is thus extremely difficult, making it impossible to hypothesize about the precise nature of the underlying process we are seeking to explain. (2) The ability to recognize facial emotion develops during the earliest part of life, about which so much remains to be learned. The remainder of this chapter, therefore, will review research into the development of recognition of emotion, without attempting to organize the findings according to particular theoretical schools.

Table II.2: Emotions examined in emotion recognition experiments with children

	Anger	Happiness/Joy	Love	Sadness	Scorn	Fear	Surprise	Disgust	Interest	Contempt	Pain/Distress	Shame	Worried	Pleased	Puzzled
Gates (1923)	✓	✓			✓	✓	✓				✓				
Kellog & Eagleson (1931)	✓	✓			✓	✓	✓				✓				
Izard (1971)	✓	✓				✓	✓	✓	✓	✓	✓	✓			
Odom & Lemond (1972)	✓	✓				✓	✓	✓	✓		✓	✓			
Stafferi & Bassett (1970)	✓	✓				✓	✓				✓		✓	✓	✓
Gitter, Mostofsky & Quincy (1970)	✓	✓					✓				✓				
Savitsky & Izard (1970)	✓	✓				✓					✓				
Dimitrovsky (1964)*	✓	✓	✓	✓											
McCluskey et al (1975)*	✓	✓	✓	✓											
Basic Emotions	✓	✓		✓		✓	✓	✓							

* vocal emotion

Table II.3: Major differences in emotion recognition experiments with children

Researcher	How emotions selected	How pictures generated	Method of testing
Gates (1923)	Diversity and easy interpretation by adults.	Six from the Ruckmick series (posed with student trained in dramatics). All the photographs were of the same white female.	Child asked to label photographs verbally. Later Gates classified responses 'liberally'.
Kellog & Eagleson (1931)	Replication of Gates (1923).	Same pictures as Gates.	Same method as Gates.
Izard (1971)	Emotions investigated in previous experiments, with contempt and disgust treated as separate emotions.	Posed actors and non-actors, all photographs judged 70% accurately by adults.	Labelling. Then tested recognition by requiring subject to select one photograph from a triad.
Odom & Lemond (1972)	Do not explain selection.	From Izard (1971)	Child asked to identify photograph of person/expression previously seen.
Gitter, Mostofsky & Quincy (1970)	Not explained	Professional actresses: 3 black, 3 white, all at 45o angle to the camera.	Child taught to associate cartoons with emotion words. When presented with photograph he pointed to appropriate cartoon.
Savitsky & Izard (1970)	Not explained - but claimed all produced at least 90% accuracy with adults.	Izard series - 8 different portrayers.	Child had to pair two from three on basis of expression or accessories.
Ekman & Friesen (1971)	Previous research.	Satisfied Facial Affect Scoring Technique.	Child had to select one photograph from two - story was eliciting stimulus.

THE DEVELOPMENT OF RECOGNITION OF FACIAL EMOTION

Before it is possible to measure an infant's ability to recognize facial emotion, it is first necessary to establish at what age the face becomes an important source of information for the infant, and the age at which he can begin to extract various kinds of information from it. Much research has been done since Charlesworth and Kreutzer's 1973 review, but although experimental measures have become more sensitive methodological problems remain.

Development of perception of faces

Why the face should attract the attention of the infant is the subject of much discussion. Koopman and Ames (1968) outlined three possible theories to explain preference for social stimuli: (1) the face may be an innate releasing mechanism for increased attention or positive affect (Bowlby, 1969; Hess, 1970); (2) social preference may be a result of progressively learned differentiations of the physical characteristics of the face (E.J. Gibson, 1969); and (3) the characteristics of the face (movement, often accompanying sounds) may provide the best source of stimulation in the infant's environment (Fantz, 1966; Kagan, 1970). Vine (1973) suggests that the two-eye Gestalt is the perceptual cornerstone on which all other social perceptions are built. It has also been proposed that the face may have become associated with feeding and other caretaking activities. Bower (1971) proposes that the infant has the ability to register almost as much information from the environment as an adult but that the infant's information processing capacity is limited and therefore the information which gets 'priority' for processing is that which is linked with survival. Fantz (1966) puts forward a similar idea of increasingly complex information processing - the infant first of all develops a schema of a face then learns to make identity distinctions on the basis of subtle cues; finally, by learning even more subtle cues, the infant learns to

differentiate between expressions.

Vine (1973) summarizes the major findings of research into the infant's perception of faces. However, studies such as those of Fantz (1961), and Haaf and Bell (1967), assume that the very young infant will perceive 'face-like' patterns as face-like patterns and discriminate accordingly. However, a face-like pattern can only be perceived as such if there is already a concept of 'faceness'. It is unfortunate that no researcher has compared fixations to photographs of faces and fixations to photographs of similar contrast, brightness and complexity, since photographs are a better representation of real faces than schematic drawings. This would give a much clearer idea of what sort of schema, if any, is developing and how it develops.

Interpreting the response of the infant to the stimuli has presented difficulties. Kagan, Hinker, Hen-Tov and Levine (1966) argued that long fixation time could arise because the relevant schema was just emerging, or because the stimulus represented a partial violation of a familiar schema, and therefore measures of smiling and cardiac deceleration should also be used. Schaffer (1971) argues that even differential behaviour does not entitle us to make suppositions about the infant comparing events with a central schema. Schaffer proposes that the infant may perceive an event as being strange only in the sense of not being familiar i.e. he finds it impossible to assimilate it to the existing schema. However, he goes on to argue that "it is not seen as unfamiliar in the sense of being different from the familiar as a result of active processing and comparison. It is only subsequently that the infant becomes capable of the latter." (p. 261). Yet Shaffer does not explain how an event can be rejected as being impossible to assimilate to the existing schema without some kind of comparison being made between the new event and the existing schema.

Even if the infant can discriminate between faces, either on the

basis of identity or expression, he may not react on the basis of that discrimination. All stimuli may be equally attractive and interesting to him. If the infant does react, there is the problem of coding his reaction - should differences in length of visual fixation or changes in his body movements or some other measure be used? Even if discrimination is established between different expressions, can we be sure that the infant is making the discrimination in terms of the emotions we hope are portrayed. Vine (1973, p. 222) suggests that not enough attention has been paid to the possibility of the infant becoming habituated to stimuli within experiments, and suggests this may explain some of the variability of results.

Changes in the area of the face the infant fixates or scans have also been noted.[22] Salapatek (1969) has shown that during the first month of life the infant fixates the external contour of any stimulus most of the time, whereas during the second month it is the internal features of the stimulus which attract most attention. Maurer (1969),[23] Bergman, Haith and Mann (1971)[24] and Donnee (1973)[25] also observed this shift in scanning. Donnee (1973) noted a return to external scanning again at 10 weeks. Maurer and Salapatek (1975)[26] plotted infants' scanning movements over a face. One month old infants scanned the external contour of the face, but the 2 month old infants scanned one or several of the internal elements.

Miranda and Fantz (1973) suggest that it is opportunity to use visual abilities which determines the development of preferences for solid, rather than two-dimensional, representations of the face. However, while Lewis, Wilson and Baumel (1971) suggest that by the age of two the child has developed a schema for the human head, but not for the whole body, their results conflict with those of Finlay, Kagan and Layne (1972). Differences in the stimuli presented may account for these conflicting results.

Carpenter (1974) found that a moving manikin or face was looked at more than a stationary one by two to seven week old infants.

Attempts have been made to establish what the infant perceives when looking at a face. Caron, Caron, Caldwell and Weiss (1973) found that in looking at faces the five month old infant exhibited three developmental changes from the four month old infant: (1) the mouth has become as salient as the eyes, (2) the head no longer has prominence over the inner face and (3) the face is seen as a distinct visual entity. This last point is also supported by the research of Fagan (1972), who found that by 5-6 months infants did have some concept of 'face'. Infants could distinguish between upright faces but not between upside down faces; this, Fagan argues, may indicate that differentiation depends on perceptual learning - i.e. the infant is only exposed to faces which are the right way up. However, no attempt has yet been made to provide infants with extensive opportunities to develop a schema for upside down faces - in the absence of a schema then greater short-term memory and comparison skills are obviously required. Goldstein and Chance (1964) showed that ability to match faces on identity increased with age. They briefly showed children a photograph and then asked them to pick the photograph from five others. Brooks and Goldstein (1963) found not only that ability to identify upright faces increased with age, but that ability to identify an inverted photograph of a familiar face also increased with age.

Blaney and Winograd (1978) showed that memory for faces improved with age, but that memory was facilitated at all ages when children were asked to make a judgment about the niceness of the photograph during their initial viewing. They suggested that this instruction resulted in additional features being sampled which assisted memory.

An important aspect of this area has been examined by Dirks and Gibson (1977), who attempted to establish if infants did see photographs

as being representations of real people. They found that 5 month old infants were discriminating between a live face and a life size photographic slide of the same person. Although discrimination was based on gross cues, such as hair style or colour, this does not detract from the fact that the infants were 'recognizing' the photographs as being representations of real people. Dirks and Gibson also attempted to assess the 5 month old infants' ability to discriminate between two live faces - however they found the infants could not make the discrimination and further research is being undertaken to attempt to resolve this anomaly.

Davies (1978) concludes that on the basis of existing evidence it is too early to decide whether a Gestalt model or a feature extraction model is operating in recognition of faces. He points out, however, that all models need to remember the physical and social role of the face.

Development of the infant's ability to recognize facial emotion

Thus it has been shown that infants do attend to faces and can discriminate between them on the basis of identity, and they can, it seems, recognize photographs as being representations of people. The face also plays an important role in the social development of the infant. Wolff (1963), for example, found that the face was the most successful elicitor of social smiling in very young infants, and he also reported that eye contact becomes the elicitor of social smiling around 4 weeks. As noted above, the problems associated with establishing what the infant 'sees' when presented with a human face are complex. Much remains to be learned about how the infant learns to distinguish between people. It is not surprising, therefore, that so little is known about the infant's ability to recognize facial emotions. Many different stimuli have been presented to infants and their responses have been 'measured' in different ways. The 'emotions' tested tend to be limited to smiling and frowning.

Ahrens (1954)[27] has shown that infants of six months respond negatively to an angry face - the vertical lines on the forehead appeared to be the key to identification. Buhler and Hetzer (1928)[28] used the infant's behaviour to gauge his response to smiling and angry faces. The responses were classified as negative (e.g. crying or motionless) or positive (e.g. smiling and happy movements). They, too, found negative responses to the angry face - by the fifth month responses to the angry face were 100% negative. Spitz and Wolf (1946), however, had not found any difference in response from six month old infants to different expressions on a mask and the experimenter's face.

In an attempt to give the infant more 'information' Kreutzer and Charlesworth (1973)[29] had an experimenter act out angry, sad, happy and neutral facial expressions with appropriate vocalizations. While 4 month old infants responded randomly to the stimuli those of six months old and over could differentiate between the emotions and responded appropriately - some even mimicking the emotion portrayed. Using live models does, of course, reduce the control over stimulus consistency but presents a stimulus much closer to real life.

Photographs portraying joy, anger, and neutral expressions were presented to 4 to 6 month old infants by LaBarbera, Izard, Vietze and Parisle (1976). LaBarbera et al. used length of first visual fixation as their measure - arguing that this is a more sensitive measure for young babies than cumulative fixation time over a specified period. The infants fixated the joy expression more than the angry or neutral expressions. The results, they argue, support Izard's theory that for the 4 to 6 month old infant recognition of the anger face would be dysfunctional - the infant is not able to cope with anger. Izard argues that biological mechanisms underlying discrete emotions become functional as each emotion becomes adaptive in the life

of the infant. As noted above Ahrens (1954), Buhler and Hetzer (1928) and Kreutzer and Charlesworth (1973) have found that the six month old infant is able to recognize angry faces and respond accordingly. Izard does not explain why the six month old infant should find recognition of the angry face is functional while the five month old infant does not. It may also be the case that it is not until the fifth or sixth month that the infant is capable of doing anything which will arouse a full expression of anger in the normal caretaking adult. There may be an interaction of many factors which determines when the infant becomes capable of recognizing specific emotions - e.g. maturation or opportunity for learning.

Wilcox and Clayton (1968) found that there were no visual preferences for smile, frown or neutral faces when the stimulus was moving. Differences were found when a 60 second stationary stimulus was used, but not when it was presented for only 28 seconds. This highlights again the need for appropriate and sensitive measures in such experiments.

Young-Brown, Rosenfeld and Horowitz (1977) claim to have obtained discrimination of some expressions by three month old infants. This is the earliest age at which discrimination has been claimed by researchers. Using a habituation-recovery-control technique, they showed that infants could distinguish surprise from happiness, and sometimes surprise from sadness - the latter only being when surprise followed sadness and when it came early in a session. If the results of Donnee (1973) were accurate and there is a shift to scanning of external features at 10 weeks, it is difficult to explain how this discrimination is taking place. It may be that the infants tested in Young-Brown et al.'s experiment had not returned to external scanning. Further experimentation is needed to establish just what is being measured by the habituation-recovery-control technique and why order of presentation should have such an effect.

There thus appears to be a period when the face is 'interesting' for the infant and commands his attention, and that gradually the infant learns to distinguish between different people and different expressions. The idea that different stimuli - or different aspects of the same stimuli - are interesting for the infant at different stages is a prevalent one in developmental psychology, but why certain aspects of the face are relevant at different stages remains to be explained. LaBarbera et al. (1976) propose that the infant's greater fixation time of the 'joy' expression may denote that the infant associates pleasant sensations with it, whereas no negative response to 'anger' faces denotes the infant has not yet learned to associate negative sensations with that expression. Again, however, we must distinguish between discrimination and recognition. It is disappointing that no researcher has attempted to find how fixation time would change if, for example, a child was habituated to a smiling face of person A, then presented with a frowing face of person A, in comparison with fixation time of a similing face of person A was replaced with a similing face of person B, and if any difference so found changed as the child developed. More information is needed not just about what discriminations the infant can make, but if, for example, identity is more salient than expression for infants - and if saliency changes over time. It is surprising that pupillary reflex actions have not been used as a measure in emotion recognition experiments. Fitzgerald (1968) showed that social stimuli (i.e. faces) produced greater pupillary reflex actions in 1 and 4 month old infants than did non-social stimuli. The four month old infants also reacted differentially to their mother's face and a stranger's face. No researcher reports having attempted to use this technique for emotion recognition experiments although it could be a useful indicator of just how early differentiation of facial emotion occurs.

As Charlesworth and Kreutzer (1973) point out, no research has been done with 1 and 2 year olds on recognition of emotion. They suggest that methodological problems alone may be responsible for this - the age group does not have the verbal comprehension of the 3 year olds nor are the behavioural measures used in younger infants appropriate for coding their responses.

The development of the child's ability to recognize facial emotion

Gates (1923) was the first experimenter to attempt to trace the development of the child's ability to recognize facial emotion. She used photographs of facial portrayals of six emotions from the Ruckmick (1921) series: pain, anger, fear, scorn, surprise and a laughing face. She selected these emotions because of their diversity and the ease with which adult subjects could recognize them. She asked the children to label the pictures and reports that she later classified the free responses 'liberally' into categories. She found that as age increased so did the percentage of children correctly identifying the picture. Although both adults and children found laughter the easiest emotion to identify, the order of the other emotions varied considerably:

child: (3-14 years) laughter, pain, anger, fear, surprise scorn

adult: laughter, scorn, fear, anger, pain, surprise.

Kellog and Eagleson (1931) replicated the Gates study with Negro children to investigate possible racial differences. However the children were judging the same photographs as in the Gates study - all of an adult white female. Kellog and Eagleson found similar rates of accuracy among the black and white children. They report that girls were consistently superior - however Gates reports girls superior only at 4, 5 and 9 (and her results for age 5 are ambiguous). Kellog and Eagleson propose that the girls are more developmentally

advanced, and hence capable of better performance in 'mental tasks'.

Other researchers, however, report different orders of difficulty of recognition of emotions (Table II.1). Methodological differences and use of different 'sets' of emotions (Tables II.2 and II.3) perhaps account for some of the discrepancies. None of the studies, however, presents data on the types of error, so it is not possible to pinpoint exactly where the differences may have had an effect.

Izard (1971) drew the distinction between emotion labelling, and emotion recognition. He found that the ability to recognize an emotion may be present for several years before accurate labelling occurs. This is not surprising since labelling relies on language development. Izard tested emotion labelling and emotion recognition in French and American children. The American children showed more rapid growth in labelling than did French children, and Izard proposed that cultural differences were responsible for this and the other differences he observed in labelling of specific emotions. Izard reports that most French children begin attending school by the age of three or four. Some children may start at two and a half or three. This, Izard argues, results in the children being more disciplined and less exposed to emotion arousing situations with parents or in free play with peers. The American child has much more opportunity to experience emotions and to be exposed to emotion vocabulary. The greater ability of the French to identify disgust, Izard suggests, arises from the French relatively greater preoccupation with food. American children recognized anger at a much higher rate at all ages, and the gap between labelling and recognition was much wider for the French. Only in recognition and labelling of two emotions - contempt and disgust - did the French exceed the American children.

Ekman and Friesen (1971) tested 6-7 and 14-15 year old children in New Guinea. Ekman and Friesen used the method first developed.

by Dalshiell (1927) who, as noted by Charlesworth and Kreutzer, did not publish details of the ages of the children, the story content, and other relevant details. The children were presented with two photographs and told a story - they then had to pick the photograph to go with the story. The average accuracy score overall was 90%. There was, however, no developmental difference - 6 to 7 year olds scored as accurately as 14 to 15 year olds. Ekman and Friesen do give a breakdown of which emotions were incorrectly chosen from the dyad, but unfortunately not all combinations of emotions were presented. Their failure to find an age related increase in accuracy may be due to the fact that all subjects had a 50-50 chance of choosing the correct photograph from each dyad, and if they knew that one photograph was not the emotion they were required to identify, then the correct one could be chosen by elimination of the other.

Savitsky and Izard (1970) presented children with triads of photographs, some of which could be paired on similarity of facial expression and some on similarity of accessories. They first established that the actual tasks of pairing on facial expression or accessories were equally difficult and that both increased with age. They then presented the children with triads of photographs from which it was possible to select two showing the same expression or two containing the same accessories. The triads were systematically varied so that all possible combinations of emotions and accessories were presented. They found that the tendency to pair photographs on the basis of facial expression increased with age - i.e. facial expression became increasingly salient. They compared their results with Izard's study of emotion recognition and found that they were parallel in two ways: (1) accuracy of both emotion recognition and pairing of photographs on similarity of facial expression increased with age, and (2) both studies showed

the same "rank of growth curves" for emotions common to both studies: anger, joy, fear and distress. They suggested that there is a relationship (the nature of which they do not specify) between the determinants of the child's interest in emotion and the recognition of emotions in other people.

Rileigh, Savitsky and Izard (1969)[30] in a follow-up study found that the tendency to form pairs on the basis of emotion cues (rather than accessories) correlated only .41 with emotion recognition scores. Izard proposes that the ability to recognize the emotions is not the only factor involved - even the youngest child considers emotion as a relevant basis for judging likeness.

Honkavaara (1961)[31] also found that young children make judgments about emotions on the basis of accessories. A girl wearing a red dress was described as happy, even though facially she portrayed sadness. Honkavaara also noted children's tendency to describe faces in terms of action - e.g. they will say "he is laughing" before they can correctly associate the appropriate emotion word. Charlesworth and Kreutzer argue that this reflects early language development where children describe objects in terms of their function.

The idea that there may be hierarchies of categories of perceptual salience was also put forward by Odom and Lemond (1974). They showed that by use of a sensitization technique, they could increase 5 year olds' ability to select a photograph which matched one previously shown, if identity was the common factor. However, the sensitization technique they used did not affect the salience of expressions. Thus, they argue, for 5 year olds identity is a more salient category of perception than facial expression.

Gilbert (1969) used seven measures of "awareness of affect" (including sorting photographs where marks were awarded for sorting by expression). Unfortunately - as Gilbert admits - social class was confounded with ethnicity in this study: Gilbert studied Jewish middle

class and Gentile lower class children. He found that Jewish middle class children were significantly more aware of affect than lower class Gentile children. First-born Jewish children were more aware of affect than later siblings. Teachers' ratings of the children showed that children with high affect awareness scores were judged to be more mature, expressive, empathic and imaginative.

Borke (1971) attempted to establish whether young children were capable of understanding emotions aroused in others. Whereas Piaget had considered the child to be primarily egocentric until at least 7 years old, Borke argued that if a child holds out a toy to another infant who is crying this shows empathy. But it could also be argued that this is a learned response - the child is simply copying the mother's behaviour. In her experiment Borke found that although initially only 44% of 3 to 3½ year olds and 69% of 3½ to 4 year olds correctly labelled a 'happy' face when asked, 60% and 92% respectively of the same children correctly chose the happy face to place in a line drawing after being told a story about the same activity. Chandler and Greenspan (1972), however, argue that Piaget's concept of non-egocentric thought includes not only accurate social judgment, but rather the ability to judge the feelings of the other when they are different from one's own. Chandler and Greenspan argued that a more accurate measure of egocentricity was to tell the child a story concerning two children. Half-way through a third child was introduced. If the subject could tell the story from the point of view of the 'latecomer' (i.e. not introducing information from the early part of the story), then this proved the child was capable of non-egocentric thought. In reply, Borke (1972) argued that if children use projection, stereotyping and identification to understand the emotion reactions of others, this is the earliest stage in the development of true empathic ability. Just as other conceptual abilities go through hierarchical stages, so too

does the development of empathy. Borke reports Sullivan (1940) observed that between 6 months and 2 years children become aware that other people experience emotions. Borke argues this is the beginning of empathy. Sullivan's views coincide with Piaget's sensory-motor stage of cognitive development. Borke also points out that Mead (1934) had argued that emergence of symbolic thought coincides with the age at which a child role-plays with dolls.

In her first study Borke found no sex differences. She proposed that parents encourage social sensitivity in both sexes. In a later cross-cultural study, Borke (1973) found that girls in both American and Chinese cultures were superior to boys at perceiving social situations. Although sex differences were a significant variable, she reports that sex contributed least to the overall variance. She suggests that one possible conclusion is that the relationship between empathic ability and sex is so small that slight differences in population sample can result in it becoming apparent or not. She does not, however, speculate on the possible differences in population sample which could account for this.

Feshbach and Roe (1968) studied empathy in six and seven year olds. They found that recognition of facial emotion was not enough to ensure empathic response. While accurate recognition may be a prerequisite for empathic responses, they argue, the response is systematically related to the perceived similarity between the child and the stimulus person.

The Importance of Areas of the Face in Conveying Information

Brooks and Goldstein (1963) and Goldstein and Mackenberg (1964) reported that the upper part of the face is more useful than the lower part in helping children to recognize photographs of familiar faces. Only Hess and Pick (1974) have investigated the salience of different parts of the face for discrimination of expression. They conducted

two experiments - the first designed to establish the relative difficulty of discriminating between nine pairs of schematic eyes and mouths. Nursery school children were asked whether pairs of eyes or mouths matched. Data obtained from this first experiment were used in the construction of schematic faces which were presented to a second group of children. Hess and Pick found that pairs of faces with highly discriminable eyes were discriminated with greater accuracy than faces with equally discriminable mouths. They therefore suggest that eyes are a more important source of information than mouths. However, the schematic faces they presented did not portray emotion expressions, and all the mouths were upturned (some children spontaneously labelled them 'smiling'). They report "Specifically the evidence suggests that changes in generally positive appearing mouths are difficult to attend to while equivalent changes in the eyes are somewhat more noticeable." (p. 1154). However, it can be argued that changes in the mouths suggested variation of intensity of only one emotion. Slight changes in configuration of the eyes can convey totally <u>different</u> emotions, and it is not surprising, therefore, that they should be more noticeable. To accurately gauge the relative importance of areas of the face in making judgments of emotion photographs of actual emotion expressions must be used.

The role of different areas of the face in assisting children to make judgments about facial portrayals of emotion has not been investigated. Ekman, Friesen and Ellsworth (1972) report that the results of studies of adult judgment of emotion from different facial areas conflict:

Ruckmick (1921) and Dunlap (1927) found the mouth superior;

Buzby (1924) reports the eyes and brow are superior;

Frois-Wittman (1930) and Coleman (1949) report no area as superior;

Hanawalt (1942, 1944), Nummenmaa (1964) and Plutchik (1962)

report that judgments may be made more accurately from the eyes for some emotions and from the mouth for others. However there is no agreement between these researchers as to which part of the face provides the best information for identification of each individual emotion.

Ekman, Friesen and Ellsworth propose that the confusion is due (1) to an unwarranted assumption that facial areas can be moved independently and (2) to a questionable assumption that there is a specific movement for each facial area for each emotion. They argue that within each facial area there may be a number of alternative movements for each emotion - some may lead the observer to make an accurate judgment of the emotion being portrayed, and some may narrow the choice of likely emotion which is then further narrowed or confirmed by inspection of other areas. However, Ekman et al. also point out that differences in methodology used may account for some of the conflicting results. Brannigan and Humphries (1972) argue that happiness and sadness can easily be identified even if only the upper or lower part of the face is viewed. They note that opposite emotion states are often indicated by opposite movements - e.g. upward and downward curving mouths. They add, however, that one section of the face may modify the expression in the other - e.g. a sad frown vs. an angry frown.

Boucher and Ekman (1975) found that the area of the face from which emotion could be most accurately judged depended on the emotion being portrayed. They divided the face on the basis of anatomical texts and inspection of faces, and selected only areas which were anatomically independent - i.e. a movement in one area did not cause a movement in another. They found, however, that some areas could not be isolated for certain emotions. In judgment of anger they found accuracy remained low across all areas and this, they argue, supports the hypothesis put forward by Ekman and Friesen (1975) that anger

is different from the other five basic emotions. Unless viewed in two or three different areas of the face simultaneously, anger, they claim, is ambiguous.

The stimulus materials used in investigation of recognition of emotion in parts of the face have varied widely - for example, Buzby used photographs of the profile of the face, Dunlap used photographs of elicited emotions, Frois-Wittman used posed expressions and drawings, and Ruckmick used sketches. The number of 'emotions' to be identified also varied dramatically - Buzby used just six emotions, whereas Frois-Wittman expected his subjects to identify fifty. Coleman found that whereas there was no superiority of either facial area when elicited emotions were used, posed emotions showed a greater superiority of the mouth region. He suggests this reflects the greater mobility and control of the mouth.

It is unfortunate that recognition of emotion in parts of the face has not been investigated in children, since patterns of recognition could provide useful indications of how and when recognition ability develops. Frijda (1970) proposes that in making judgments about emotion adults first decide whether it is pleasant or unpleasant. If children make judgments of emotion in a similar way, then since happiness is the only basic emotion represented by an upturned mouth, it would be reasonable to expect them to identify happiness from the mouth alone once they can recognize the full facial expression. If Gibson (1969) is right, that it is on the basis of increasingly fine distinctions that recognition proceeds, then recognition of the happiness eyes should come later than recognition of the happiness mouth - i.e. the distinction between the eyes portraying happiness and eyes portraying the other emotions is less obvious than between the mouths.

As shown above, the investigation of emotion recognition ability in children has been fragmented and unsystematic. This is reflected

by the fact that when Argyle (1975) outlines how bodily communication is interpreted in social interaction he surprisingly gives relatively little consideration to decoding of facial emotion generally - and even less to its development in children. Development of recognition of emotion is dismissed in general terms in only one paragraph (p. 113):

> "It is not really known how early children can recognize emotions. Probably they respond to smiling and frowning quite early. They probably respond to rough and gentle handling even earlier ... The number of emotions which can be correctly identified from photographs increases with age - pain at 6-7, anger at 7, fear and horror 9-10, surprise 11, contempt 18 and later. This depends in part on the development of words and concepts for emotions." (Argyle, 1975).

Although we do know more than Argyle reports, there is still relatively little detailed knowledge about the development of recognition of facial emotion. Harper, Wiens and Matarazzo (1979), in their review of nonverbal communication research, admit that they rely heavily on Ekman, Friesen and Ellsworth's (1972) analysis of research into recognition of facial emotion. In doing so they, like Ekman et al., do not discuss emotion recognition in relation to children. Children are only mentioned once in Harper et al.'s chapter on facial emotion - and then it is in commenting that children judged to look happy when viewing T.V. violence engaged in significantly more postviewing aggression (Ekman, Liebert, Friesen, Harrison, Zlatchin, Malmstrom and Baron, 1972). There has thus been little recent progress in investigation of the development of children's ability to recognize facial emotion. Perhaps the most glaring deficiencies of research to date are (1) there has been no analysis of types of recognition error made by children and (2) there has been no systematic investigation of the relative importance of different areas of the face when children are making judgments about emotions.

Emotion recognition in relation to other abilities or factors

Various researchers have attempted to establish what factors are linked with ability to recognize facial emotion. Staffieri and Bassett (1970) relied on verbal labelling to assess whether birth order affected emotion recognition skills. They used 10 and 11 year olds - proposing that later siblings would have superior ability since they had more contact with peers, but no such difference was found. Some sex differences were found however - girls were superior in identifying emotions portrayed by the adult male and the female child, boys were superior in identifying emotions in the adult female. The 11 year olds were more accurate in their perception of the child pictures than were the 10 year olds. It would be useful to examine the 'other side of the coin' - would 'only' children be initially superior at identification of adult portrayal of emotion, since they would have had relatively more exposure to adults and less to children? Zajonc (1976) proposes that a child's intelligence is systematically influenced by the number and intellectual maturity of persons with whom the young child has contact. Since Stafferi and Bassett used only 10 and 11 year olds, it may be that any differences produced in early childhood had been outweighed by later social experience.

In 1972 Odom and Lemond attempted to establish what relationship, if any, there was between ability to recognize emotions and the ability to produce facial expressions associated with emotions. They investigated eight emotions: fear, distress, shame, disgust, interest, surprise, anger and joy. They found that children scored higher on emotion recognition than emotion production for all the emotions except joy and interest, and there was no reduction of the lag between recognition and production ability with age. They found an age related increase in recognition, but production did not increase to the same extent. (However, as they point out even adults may have difficulty in producing the

expressions to order.) Since, however, they were using a selection from the series of photographs generated by Izard (1971), it is not surprising that there should be a difference between judgments of these photographs and those of emotion portrayals produced by the children on demand. The Izard series contains only those pre-judged as accurately portraying the emotion by 70% or more subjects (see Izard, p. 246). From Odom and Lemond's data it is not possible to establish if individual children who were superior (for their age) on recognition were also superior on production.

Studies with adults (e.g. Buck, Miller, Savin & Caul, 1972) had shown that externalizers (those who show emotion externally but with little disturbance of GSR or heartrate) tend to be female and extravert and internalizers (who show little emotion, but marked disturbance of GSR and heartrate) tend to be male and introvert. Externalizers could 'send' accurate emotion messages to others, but were poor judges of emotion in others; while internalizers were poor portrayers of emotion but accurate judges of emotion in others. Buck (1975) conducted a study with children in which he found that personality differences associated with sending ability in adults were present in children, but that the sex related difference was not. He proposes that in the young children he tested the usual socialization of boys not to show emotion had not yet taken effect. The number of subjects in Buck's experiment was small and the children's 'sending' ability was merely being judged along the pleasant/unpleasant dimension as they viewed pleasant and unpleasant slides: there are obvious ethical and methodological difficulties which prevent eliciting all the emotions in young children.

Buck (1975) found sending ability was positively related to high activity level, direct expression of hostility, being an extravert and having many friends at school, and negatively related to emotional control, solitary play and shyness. In adults it has been suggested

the characteristics associated with high sending ability are opposite to those associated with high recognition ability. However, although it is thus reasonable to hypothesize that children with high recognition ability would be introvert, shy and show emotional control, it is not reasonable to assert that these children would be the ones who are the least popular. Being a good judge of emotion in others is a prerequisite for being a successful social interactor.

Hamilton (1973) also investigated production of facial expressions: he asked children to imitate happy and sad faces, and when they had done so they were rated for expressive ability. The children then watched a happy or sad film and their spontaneous facial expressions were coded by observers who did not know what film was being shown. Children who had been rated on the first test as high on expressive ability gave the most differentiated spontaneous facial responses to the happy and sad films.

Gitter, Mostofsky and Quincy (1971) attempted to establish if race or sex differences affected emotion recognition. They first trained children to associate cartoons with emotions. Photographs of facial expressions of anger, happiness, surprise and pain portrayed by three black and three white female expressors were prepared. The children were then asked to pick the appropriate cartoon for each of the photographs. Gitter et al. found that children identified happiness most easily, followed by pain, anger and surprise. Race and sex differences were not associated with accuracy and they therefore propose that race and sex differences which have been noted in adults by other researchers may be generated by cultural forces, rather than any inherent differences between the races or sexes. Their only significant results were an age related increase on accuracy and the 'order of difficulty' of recognition of the emotions.

Wolman, Lewis and King (1971) showed that as age increases children report that the conditions which arouse emotions occur more frequently within them - i.e. they rely on internal cues. Wolman et al. discovered no link with intelligence, socio-economic level, birth order or school performance, but boys in the 10 to 13 age group appeared to be more independent of external cues than girls.

Izard (1971), however, found that recognition and labelling of emotion was positively related to socio-economic level. He proposed that inability to recognize facial emotions may be a useful indication of inadequate social development. However, it must be remembered that accurate recognition does not adequately endow the child with the ability to act appropriately on the basis of that recognition.

Gilbert's results (1969) indicated that children with high 'affect awareness' were rated as more expressive, mature, empathic and imaginative by their teachers. He proposed that a child's awareness of affect concepts provide him with an overall 'orientation' which he would apply both to himself and in interaction with others. The idea of an overall 'orientation' being applied is akin to what cognitive-developmental theorists propose happens as the child passes through the various stages they outline.

Wallach and Kogan (1965) proposed that emotion recognition was linked to creative thinking, and Rothenberg (1970) found that social sensitivity was related to interpersonal adjustment. However, Rothenberg used the child's ability to describe the feelings of actors portraying happy, sad, angry or distressed behaviour as his measure so it is perhaps not surprising that success on this task is related to the child's ability to interact successfully. Such claims seem to tend towards an argument that there is some kind of 'general emotion ability' which pervades many areas of the child's consciousness

and behaviour. However, no such 'general emotional ability' has been found in adults (e.g. Beldoch, 1964; Levy, 1964).

So far as intelligence is concerned, Kellog and Eagleson (1931) in their replication of Gates's study found that there was a rough positive relationship between emotion recognition and the teacher's ratings of intelligence. Izard (1971) also obtained low to moderate correlations between intelligence, and emotion recognition and emotion labelling scores, and Rothenberg (1970) found ability to understand another person's behaviour clearly improved with increasing level of intelligence. Dimitrovsky (1964) found the correlation between ability to recognize vocally portrayed emotion and verbal mental ability was significant only for the 5 year olds.

Evidence regarding sex differences in skill of recognition of facial emotions is contradictory. Staffieri and Bassett (1970) found girls more accurate in perception of emotions portrayed by the adult male and female child, and boys more accurate in recognition of emotion portrayed by the adult female. As noted above, however, Gitter et al. (1971) found no sex differences in judging emotions portrayed by the adult female. Gates (1923) reports girls superior at 4, 5 and 9 and boys at 5, 6, 7 and 8 (her results for age 5 are ambiguous). Kellog and Eagleson in their replication found girls consistently superior at all ages. In Borke's empathy study in 1971 she reported no sex differences in empathic ability, but reports a sex difference in her 1973 study. Dimitrovsky (1964) found that girls were more accurate than boys in recognition of emotions portrayed vocally. Only among 5 year olds did boys obtain higher scores than girls. She suggests that as socialization progresses girls become aware that they are expected to be sensitive and intuitive and boys become aware they should be active and objective.

While researchers have investigated the role of social interaction with the mother or other caring adult in the development of emotion expression in infants, the role of social interaction in the development of emotion recognition has not been investigated. Thus e.g. Bowlby (1953) and Goldfarb (1955) argue that lack of positive emotional contact with a mother or mother substitute has serious consequences for an infant. Goldfarb argued that emotional and intellectual development were severely retarded where infants were reared in an impersonal institutional setting, and that it was inhibition of emotional development which resulted in intellectual retardation. Kistiakovskaia (1965) also expressed the view that the development of positive emotional reactions was critically linked to the neurological, mental and physical development of the child (reported in Izard, 1971, p. 67). However, her hypotheses do not take account of how, for example, blind children develop positive emotions, since she does regard the visual ability of the child to be linked to emotional development.

Stone (1954) re-examined some studies of children reared in the isolation of institutions. He considers that there is a minimum level of social interaction required to ensure normal development of the infant.

Argyle (1975) reports that Bateson et al. (1956) have suggested that if children are exposed to conflicting emotional messages then they are in danger of developing schizophrenia. They suggest that the schizophrenic's inability to decode emotional messages from others is a result of parents, for example, portraying anger facially while vocally conveying a different emotion, or contradicting the verbal message by the tone of the voice. The child thus cannot develop the ability to decode emotion messages, and hence cannot interact properly socially.

Given the importance of social interaction in the development of the infant it is thus surprising that amount of interaction with the mother, and the quality of that interaction, have not been used as variables in recognition of emotion experiments.

Kagan (1969) found that infants of high socio-economic status (SES) mothers seemed to have "greater social schema development" than lower SES infants. Hore (1970)[32] and Schmidt and Hore (1970) found that high SES mothers looked at their children more often and reciprocated more of the children's glances. Vine (1973, p. 285) suggests that these results indicate that "it is probable that early interaction patterns are maintained during childhood, and probably affect the child's expectancies in interpersonal encounters.". As noted above, mutual gazing provides an ideal opportunity to learn about facial expressions (although it remains to be shown that high SES mothers engage in more mutual gazing than low SES mothers in all situations - e.g. when disciplining the child).

Thus there is still no clear-cut idea of what factors 'produce', or are correlated with, an individual with high ability to recognize facial emotion or above average 'social judgment' skill. It cannot even be claimed that all researchers have found that accuracy in recognition of emotions increases with age, since Ekman and Friesen (1971) found no developmental trend.

Errors made in Emotion Recognition

None of the studies of emotion recognition in children has presented data which can be analysed to identify which, if any, emotions children systematically confuse and which, if any, they never confuse. Ekman and Friesen (1971) indicate which was the 'incorrect' emotion in the dyads presented to children, but this cannot be analysed to identify the emotions most commonly confused, since there was not a free choice of alternatives, and not all combinations of emotions were presented. Ekman, Friesen and Ellsworth (1972) examined the adult studies (only five in all) which had looked for 'common confusions' and report that "only two category relationships found by more than one investigator were not directly contradicted by more than one

other investigator". (p. 62). The two category relationships were:

> Fear/Surprise/Interest: Fear and Surprise were confused with each other. Surprise was mistaken for Interest (but not vice versa).
>
> Anger and Disgust/Contempt: Anger and Disgust or Contempt were often mistaken for each other.

Ekman, Friesen and Ellsworth suggest that the contradictions among the studies are not surprising, since the evidence used to establish that common confusions do exist is itself often confused. They argue that confusions can arise for two reasons:

> 1. The photographs presented for judgment are actually a blend of two, or more, emotions.
>
> 2. There will be uncommon confusions made by small, and in some way unusual, sub-samples of subjects.

The most comprehensive attempt to explain types of errors made in emotion judgment tasks was made by Tomkins and McCarter (1964), who suggested seven reasons why errors were made:

1. Gross differences between emotion expressions are learned better than fine differences, and where learning is involved differences in skill attained will appear.

2. Similarity between affects: They identify five ways in which 'similarity' between emotions may result in errors of identification: (i) similarity in neural firing pattern; (ii) similarity between stimulus conditions which elicit the emotion; (iii) physiological changes, such as rate of breathing, may be common to several emotions; (iv) combinations of emotions may occur simultaneously or in rapid sequence; (v) there may be learned associations.

3. There may be a predisposition to choose some emotions more often than others - a happy person may choose the happy face more often in error. (They termed this increased density.)

4. Because an individual may not experience the emotion himself, or observe it in others, he may misread the emotion when

presented with it. (They term this attenuation of density.)

5. Conjoint attenuation and increasing of density: This they say is irreversible confusion. Thus, for example, Fear would be consistently labelled Surprise, but Surprise would not be labelled Fear. Irreversible errors, they argue, arise from some taboo which leads to the individual identifying the 'safer' emotion. Reversible errors, they argue, arise simply from the lack of discrimination between two emotions.

6. Deficiencies in stimulus photographs: The photographs presented may be blends of two, or more, emotions.

7. Linguistic conventions: The subjects' lack of vocabulary to distinguish between the more subtle emotions may result in e.g. 'ashamed' being labelled 'upset'.

Tomkins and McCarter applied this analysis of errors to their research data and report that their model of types of error was supported. They report the most common confusions were:

Table II.4: Common Confusions reported by Tomkins and McCarter

Posed Affect	Most Common Confusions
Interest	Neutrality, Surprise
Surprise	Interest
Neutrality	Interest
Fear	Surprise
Anger	Disgust
Shame	Distress; Neutral
Distress	Shame

However, two points must be remembered. First, in the Tomkins and McCarter study, emotion recognition was tested by passing round photographs of emotion portrayals, and subjects indicating on a prepared sheet which of the nine emotion categories was portrayed in each photograph. To try to eliminate linguistic difficulties categories had comprehensive labels such as "Surprise, startled, amazed, seeing the unexpected". Thus the task the subjects were performing was distinguishing between groups of emotion labels to apply to a given photograph. We

cannot be sure, therefore, that the results reported would be identical to those which would be obtained if an emotion label were given and the subjects had to discriminate between a set of emotion portrayals.

Second, many of the reasons why errors occur, cited by Tomkins and McCarter, can be explained in terms of other theories. Information processing theory, cognitive theories, Social Learning Theory - even psychoanalytic theory - could supply explanations of why, for example, Fear may be labelled Surprise. Errors can also be explained in terms of other theories of emotion - e.g. in terms of Plutchik's theory we would expect adjacent emotions (such as Fear and Surprise) to be confused more often than emotions which are opposite to each other on his model (e.g. Fear and Anger).

Bassili (1978) tested recognition of emotion from normal still photographs, and from a moving film which only showed the movement of the face (the face was blackened and had white dots painted on it). Subjects were asked to identify which of six emotions was being portrayed. Bassili concluded that the technique he used demonstrated "that feature based information is not necessary for face perception in the same way that photographs demonstrate that motion information is not necessary." (p.378). He reports that the errors made were similar in both conditions. The most common errors he reports are:

Table II.5: Common Confusions reported by Bassili

Correct Emotion	Emotion Label Given	
	Full Face	Movement
Happiness	Surprise	Surprise
Sadness	Disgust	Disgust
Fear	Surprise	Disgust
Surprise	Fear	Disgust
Anger	Disgust	Disgust
Disgust	Fear/Anger	Surprise

Thus, although Bassili and Tomkins and McCarter were examining different groups of emotions, both found (in recognition of still photographs) that Fear was confused with Surprise, and Anger was confused with Disgust (in the case of Bassili the confusions are 'reversible').

Bassili reports that the main confusions of emotion when judgment was made on movement alone were the same as those made in judgment of the full face for Happiness, Sadness and Anger. Since Surprise and Fear are confused in the full face it is interesting to note that for both Surprise and Fear, Disgust was the most common error when judgment was on the basis of movement alone. Also, while Disgust was labelled Surprise, Surprise was labelled Disgust - a 'reversible confusion' not found in labelling of emotions in the full face.

There is no study which has investigated common confusions, and which has presented several emotion portrayals and asked the subject to select the one which portrays a given emotion. This, it is submitted, is a more rigorous test of discrimination between emotion expressions than the commonly used labelling methodology.

SOME METHODOLOGICAL CONSIDERATIONS

Throughout the previous section methodological difficulties encountered in studies of emotion recognition in children have been discussed. This section will consider further the methodological problems peculiar to such studies. Comparisons with adult studies will be drawn, and it will be shown how the pilot study methodology was evolved. Much research has been undertaken with adults on recognition and labelling of facial emotion, but relatively few studies have focussed on the development of these abilities in children. The few studies undertaken differ in very important ways (Table II.3). Ekman, Friesen and Ellsworth (1972) reviewed research in the field of emotion

recognition and labelling and considered many of the methodological problems surrounding it. However, they excluded studies of children from their review because there were relatively few studies, and the methodological problems surrounding them were so different from those encountered in adult studies. This section will briefly discuss some of the arguments presented by Ekman, Friesen and Ellsworth on methodological questions relating to adult studies. The need to modify these arguments with reference to studies with children will then be discussed, with particular reference to the study to be undertaken.

Categories of Emotion

Argyle (1972) and Ekman, Friesen and Ellsworth (1972) point out that researchers from many different theoretical perspectives have selected the same 'basic' emotions for study - Happiness, Surprise, Fear, Anger, Sadness and Disgust (with Interest added in a few studies). They were, of course, referring to adult studies. Comparison of studies of children shows much less consistency in the emotions examined (Table II.2). Gates (1923), for example, selected emotions because of their diversity and ease of interpretation by adults; Stafferi and Bassett (1970) and Gitter, Mostofsky and Quincy (1970]) give no explanation of why they selected specific emotions to examine. Argyle (1975) points out that research findings with adults indicate that judges have difficulty when required to differentiate between more than seven emotions. When seven categories are used accuracy is about 66% overall, whereas it drops to 13% with forty categories.

Posed/Unposed expressions and One actor/Many actors

One of the first decisions which must be made in setting up recognition and labelling of emotion experiments is whether to use posed or unposed expressions.

The advantages of using posed expressions are obvious. An attempt can be made to get a portrayal of 'pure' emotion and avoid a blend which

subjects might find confusing. All the photographs can be taken under controlled conditions, so a set of photographs can be produced which is matched for clarity, contrast and size. However, there are also problems in ensuring that posed expressions accurately reflect emotions portrayed in real life. There is also the difficulty of ensuring that all the actors used for posing are equally skilled in producing, on command, all the facial expressions of emotion required.

But using unposed expressions - whether produced in the laboratory or in natural circumstances - also causes difficulties. In the laboratory we may get a blend of emotions portrayed, and we cannot be sure that if, for example, we give a subject a sudden electric shock or make a loud noise that the 'surprise' expression we obtain is the same as it would be in natural circumstances. Nor can we be sure that the eliciting circumstance will arouse the same emotion in all the subjects to the same intensity. If, on the other hand, we use photographs of spontaneous facial expressions, portrayed in emotion provoking circumstances in natural surroundings, we may not be able to control the quality of the photographs - and cannot be sure that the subject was totally unaware of the camera. More importantly, however, we may again be faced with a blend of emotions - and even the subject may be unable (or unwilling) to explain the full extent of his feelings at the moment the photograph was taken. It is difficult to imagine any event which we could claim aroused only Anger, or only Surprise, in a subject, if we did not have some knowledge about the life and psychological make-up of the individual. Indeed we could argue that pure expressions of one emotion are relatively rare in real life, and judgments should be made on the basis of the most dominant emotion. If we add problems of social norms which may decree, for example, that in some circumstances emotions should be masked, and factors in the individual which may cause him to inhibit full expression, then it appears that posed expressions, though artificial, may be the only

answer if experimental variables are to be adequately controlled. Argyle (1975) points out that posed photographs produce much the same levels of accuracy as do photographs of spontaneous portrayals of emotion.

A related question is that of the number of actors portraying each emotion. Ekman et al. argue that as many actors as possible should be used to ensure that it is not the ability of any given actor to portray emotions which is being judged. Studies with children have varied widely in their method of generating the stimulus photographs. Gates (1923) used six pictures from the Ruckmick (1921) series, all posed by the same actress. To generate his series, Izard (1971) obtained posed expressions from professional actors and others. Any pictures which produced 70% or higher accuracy scores when judged by adults were included. Stafferi and Bassett (1970) do not explain how their pictures of two adults and two children were generated; Gitter, Mostofsky and Quincy (1971) used professional actresses - at a 45^{o} angle to the camera.

In studies with children there are several factors which must be considered which do not apply to adult studies. As outlined in the previous sections, children may make judgments about people and emotions on the basis of many cues - some of them inappropriate. It is therefore important to reduce as many of these inappropriate cues as possible. Since it would be difficult, if not impossible, to obtain spontaneous pure expressions of all the emotions from a single actor, posed expressions must therefore be used. Use of a single actor has the added advantage of reducing the amount of 'information' the child has to process.

Context/Context free pictures

As pointed out by Ekman, Friesen and Ellsworth no study has

fully examined how context and facial expression combine to give information about the situation, and the emotion being experienced. The choice of whether or not to supply context in the pictures is dictated by the methodology to be used. In studying children where stories are to be the eliciting circumstance (and pointing to a photograph the response) the setting would have to be the same in all the photographs. This would avoid cues from the story being matched to the context without consideration of 'emotional' meaning or content. Contexts have not been presented in the stimulus photographs used in recognition of emotion studies with children.

Motion pictures vs. still pictures vs. live actors

Although there is little difference in accuracy in judgments about emotions made from still pictures and motion pictures (Argyle, 1975, p. 215), the decision to use either of these stimuli (or live actors) is an important one.

Experimenters who have attempted to use live actors have experienced several difficulties. The actors may not give consistent performances if all the subjects are not present together. It can also be argued that if a lot of subjects do witness one performance then they will be an 'artificial' distance from the actor - i.e. not the distance usually adopted in social interaction. In addition, some researchers have found that actors may be unable (or unwilling) to portray emotions such as 'love' in front of a live audience although they have no difficulty if performing to a camera.

Thus, while motion pictures and photographs are more artificial than live actors, they do give the experimenter more control over variables. Whether live actors, motion pictures or photographs are to be the stimuli must be considered in relation to the response one is expecting from the subject. Every effort must be made, particularly in studying children, to make the response required as simple as possible.

Although Charlesworth and Kreutzer did use live actors in attempting to establish emotion differentiation in young infants, all of the studies which have tested emotion recognition in children have used still photographs.

Labelling as response

A popular method of testing both adults and children has been to present a photograph which is then labelled by the subject. With adults the subject may be presented with a list of emotions and asked to pick the appropriate one for each photograph. Often several spurious emotions are added to the list to avoid identification by elimination, and possible bias of the judgments made.

Occasionally free response is invited, with the responses being grouped by the experimenter later and judgments made as to accuracy. This also presents problems, since criteria against which to judge accuracy have to be laid down. Gates (1923) used labelling as her measure.

Although at first sight labelling appears to be a suitable method for use with children, many difficulties surround its use. Firstly, labelling depends not just on the verbal comprehension of the child but also on his verbal expressiveness. Some children may, for example, know that a face is happy, but for various reasons (e.g. shyness, speech defect) be unable to convey this to the experimenter. There is the added problem that children can often understand and manipulate a concept mentally before they are able to articulate it. Izard (1971) has shown that a child can recognize a facial expression of emotion up to two years before he can correctly label it. With young children, therefore, labelling is not an accurate measure of emotion recognition.

Non-verbal responses

In an attempt to overcome the problems of labelling, some researchers have attempted to develop a methodology where children can

respond by pointing to a photograph. Two or three photographs are presented and the subject is asked, for example, to pick the one which is 'happy'. All that is thus required is for the child to point to the photograph - no verbal ability is needed, although of course the subject has to understand the instruction and the concept of the particular emotion he is being asked to identify. Researchers who have used this method present triads of photographs which may have been systematically varied - any emotion can thus be said to have been discriminated from all others - or randomly allocated. Izard used random allocation (with certain over-riding rules such as no triad was to contain two photographs of the same emotion). He had 36 triads in his recognition experiment. With young children this seems a cumbersome procedure. A difficulty with this method is that the subjects have a 1-in-3 chance of being right. In some triads the chance of being right will be 1-in-2, since if the subject knows that one of the photographs is not the one he has been asked to identify, then there are only two others to choose from. Identification by elimination of two known photographs is also a possibility. Izard, however, does not discuss these possibilities nor does he take them into account in presenting his accuracy rates.

In an attempt to develop a non-verbal method of measuring emotion recognition Gitter, Mostofsky and Quincy (1971) taught children to associate certain cartoons with given emotions. The children were then shown a photograph, and asked to point to the cartoon which went with the expression. While this may be feasible when only a few emotions are being examined (Gitter et al. were examining only four) the time needed to teach very young children the 'correct' cartoon for more than four emotions would be excessive. Gitter et al. do not explain how the cartoons were generated - nor how they ensured they were appropriate for the emotion being shown.

With very young children it is often not enough to simply ask "show me the one who is happy" - in an effort to supply the child with more 'information' stories of just a few lines have been presented by several researchers. The stories outline some situations which it is assumed children would understand and could arouse the specific emotions. Since Wolman, Lewis and King (1971) have shown that young children judge emotions on the basis of external cues (as opposed to cues within themselves), it is important that the stories used in such experiments should have adequate external cues.

This section has attempted to highlight the methodological problems peculiar to studies of recognition of facial emotion in children. As has been shown above, the studies undertaken with children have varied widely in terms of number and age-range of children, number and range of emotions examined, and in methodology. In studying recognition of emotion in children three major problems must be solved - the need for the method to be simple and as independent of verbal ability as possible; the need to avoid the possibility of judgments being made on the basis of inappropriate cues or by logical strategies; and the need to reduce information processing demands which are not related to judgments of emotion as much as is practicable. These factors can be overcome, as has been argued above, by making the response required non-verbal and using the same actor to portray all the emotions. This does not, of course, completely remove all verbal factors - comprehension of the emotion word, story and instructions (however simplified) is still required - but it does reduce the degree of verbal skill involved. Arguments against using only one actor are, it is submitted, outweighed by the other considerations discussed above.

CONCLUSION

Although research is increasing our understanding of the processes of visual perception in young infants, our knowledge of what such perceptions 'mean' to the infant remains limited. Studies have shown that infants appear to discriminate between faces both on the basis of the individual's identity and the facial expression portrayed. It is unfortunate that no study of infants has attempted to establish if one of these categories dominates over the other, or whether any such dominance varies over time.

We do know that children can identify facial emotions from photographs, but we still do not know more precisely how the child begins to distinguish between facial expressions, and how he begins to attach the correct meanings to them. Analysis of types of recognition error is not presented in any of the studies of emotion recognition in children, and it is not possible therefore to analyse what emotions are confused and what emotions, if any, are never confused, and whether patterns of error emerge as the child gets older. It is reasonable to hypothesize that errors may become more systematic as the child gets older because (1) known emotions can be eliminated and will not be chosen in error, and (2) as the child's ability to analyse faces increases he is more likely to choose, in error, the expression most like the correct one. Experiments to date have examined different 'sets' of emotions and this makes comparison of results difficult. Table II.1 sets out the rank order of difficulty of recognition of facial emotion as reported by researchers. From this, all that can be reliably stated is that most researchers report that Happiness is the first emotion accurately recognized.

It is not possible to establish if there is a 'general ability' for decoding emotion messages since, for example, recognition of facial emotion and vocalised emotion has never been studied in the

same population of children. Studies of recognition of vocal emotion have not used the same kind of methodology as studies of recognition of facial emotion (nor looked at the same 'set' of emotions), so even crude comparisons are not possible. Beldoch (1964) studied adults' ability to identify vocal, graphic and musical expressions of emotion and found individual differences in sensitivity were consistent across all three judgment tasks. However, although Levy (1964) found that those accurate in identifying vocal emotion in others were also good 'expressors' of emotion to others, later research using judgments and portrayals of facial emotion (e.g. Lanzetta and Kleck, 1970) has contradicted this. Research continues to examine the hypothesis that there are extravert externalizers (whose emotional state others can judge accurately, but who are poor judges themselves) and introvert internalizers (who are good judges of others' emotional states, but who do not express emotion externally).

Links with intelligence have been suggested, but our knowledge of any such link remains limited. Other social judgment abilities have been related to interpersonal adjustment, birth order, and social background, but the critical factors remain elusive - not surprisingly, since researchers have defined 'social judgment' in terms of many different tasks.

Development of a non-verbal, yet accurate, measure of emotion recognition remains elusive - perhaps because of the nature of emotions. Because we cannot be sure that any given situation will suggest the intended emotion to all subjects, it is not possible, for example, to present pictures with the faces removed and instruct subjects to select the appropriate expression. While this would be non-verbal, it also demands comprehension of the picture - a task which may prove more difficult than comprehension of a verbally presented story. Although photographs of the basic emotions could be presented and the subject

asked to point to the photograph which 'matches' a vocal portrayal of emotion played to him, this would not be a measure only of recognition of facial emotion. The nature of emotions is such that to get an acceptably 'pure' measure of recognition of facial emotion (and to be sure the subject understands the discrimination he is making and is discriminating on the basis of emotion and not some other factor) some level of verbal communication is necessary between subject and experimenter. In studies with children this verbal content must be reduced as much as is feasible. An attempt has been made in the previous section to outline how the constraints surrounding study of children's recognition of facial emotion may be reduced. It has also been shown how, in reducing the constraints, it is necessary to accept limitations of research design (e.g. only using one male and one female actor) which in adult studies would be questionable.

Charlesworth and Kreutzer (1973) point out that there is one large gap in understanding emotion recognition in children which remains untouched - how much attention do children pay to facial expressions in their everyday interactions, in comparison with that they give to other social cues. Bugental, Kaswan, Love and Fox (1970), however, did attempt to establish if there were differences in the amount of attention given by adults and children to the facial expression, tone of voice and words used by actors when the affect (positive, negative or neutral) conveyed in the channels was systematically varied. They found that for young children the visual message was less important than the verbal message. They also found that the 5 to 8 year olds perceived women's smiles as neutral or only weakly positive, and suggested this may be because the female smile is ambiguous, and may be present in situations where negative affect is being conveyed to the child. This study, of course, was examining positive/negative/

neutral affect and not emotions as such. Before it is possible to undertake systematic examination of attention paid by children to facial emotion cues in everyday interactions, much more detailed knowledge is needed of the development of recognition of facial emotion.

CHAPTER III: PILOT STUDIES

INTRODUCTION

As discussed above, the methodology used by researchers such as Izard (1971), where children were presented with a triad of photographs from which they were asked to select the one which portrayed a given emotion results in (a) not all combinations of emotions being presented, (b) a high rate of accuracy expected by chance and (c) results which cannot be analysed to allow identification of 'common confusions'. Pilot Studies were therefore designed to develop a new methodology for emotion recognition, and a method for testing children's ability to match faces on the basis of emotion portrayed. As experimentation progressed, it became apparent that a group test of emotion recognition was practicable, and thus a group form was developed in Pilot Studies III and IV.

Because of the small numbers involved in the Pilot Studies it would have been meaningless to apply rigorous statistical tests to the results obtained. The results were thus analyzed at a basic level to establish if the methodology worked, and to identify any discrepancies which might have been a result of faulty method design.

PILOT STUDY I: To investigate if young children could select one expression from seven in response to being read a short story.

Purpose:

As noted above emotion recognition research with adults had, in many cases, concentrated on the six basic emotions (often with Interest added as a seventh). Studies with children varied widely in the numbers of emotions investigated, and in the emotion labels used. Gates (1923), for example, selected emotions for their diversity and easy interpretation by adults. She examined recognition of six emotions while Izard (1971) examined recognition of nine. However, neither study included all the 'basic' emotions. For the main study it was intended to present photographs of the six basic emotions, plus Interest, simultaneously, and ask the child to point to the photograph which matched an auditorily presented story. This method would, it was hoped, allow analysis of types of recognition error. Since no previous study had required children to pick one face from seven, it was necessary to establish that this was a suitable methodology for use with young children.

Subjects:

Ten children (six boys and four girls) at the Staff/Student Creche of Queen's University, Belfast, were tested. The youngest child was 3 years 6 months and the oldest child 4 years 11 months. The average age of the children was 3 years 11 months.

Materials:

(1) Photographs: The emotions to be studied were Anger, Disgust, Fear, Happiness, Interest, Sadness, Surprise. Photographs of male and female portrayals of each of these emotions were selected from Unmasking the Face by Ekman and Friesen (1975). The criteria for selection were as follows:

(i) the photograph should be of one emotion and not a blend of several emotions (as defined by Ekman and Friesen);

(ii) the photograph should attempt to portray the single emotion fully (as defined by Ekman and Friesen), e.g. anger and not slight anger;

(iii) application of the first two criteria resulted in three emotions being portrayed by the same actor. To avoid further over-representation of any particular actor it was decided that the number of emotions portrayed by any actor should be restricted to three. (It had been hoped to have all the emotions portrayed by one male and one female actor, but this proved impossible. It was subsequently established that several sheets of photographs were missing from the Ekman and Friesen book).

(iv) the photographs should be of equal size and clarity. (Unfortunately Ekman and Friesen give no examples of the Interest expression. To avoid inclusion of a photograph of different size and quality (which would have drawn attention to that photograph) it was considered preferable to use a 'neutral' photograph from the Ekman and Friesen series. This, admittedly unsatisfactory, compromise was suggested by Odom and Lemond's (1974) finding that the neutral expression was more similar to Interest than to any other. A preliminary test with several adults indicated that the neutral expressions chosen were acceptable as Interest photographs - though choices may have been made by elimination.)

The pictures chosen were:

Anger: p. 187 (photo 27), p. 185 (photo 24)
Disgust: p. 181 (photo 16), p. 183 (photo 18)
Fear: p. 62, Figure 22 (male and female)
Happiness: p. 191 (photos 33, 34)
Interest: p. 38, p. 51 (examples of neutral)
Sadness: p. 195 (photos 42, 44)
Surprise: p. 45, Figure 11 (male and female)

The photographs were then arranged on two 10" x 15" sheets - one for female portrayals and one for male. The following criteria were applied:

(i) no photograph was in the corresponding position to the order in which the emotion was to be identified - e.g. fear, which was the first emotion to be identified, was not first on the left;

(ii) no emotion was in the same position on the male and female sheets;

(iii) emotions portrayed by the same person were not adjacent.

The layout was as follows:

Male: happiness disgust interest anger
fear sadness surprise

Female: surprise anger sadness fear
happiness interest disgust

In half the trials Male faces were presented first and in the remaining half Female faces were presented first.

(2) Stories of two or three sentences were composed describing a situation which would give rise to each emotion. Since the subjects would not be required verbally to label the emotions portrayed, nor make judgments about which emotion was being experienced, the stories included the emotion label. These stories took into account descriptions of emotions given by children in Plutchik's experiment (Plutchik, 1962), sentences used by Izard (1971) to help explain emotion words, and the types of situation which Borke (1971, 1973) described in her stories when testing egocentrism.

Male and Female versions of the following stories were prepared:

Fear: He/She was walking through a wood all alone in the dark and he/she heard a very strange noise behind him/her. He/she felt afraid - how would he/she look if he/she was afraid?

Anger: Some boys were playing football and they kicked their football through his window. He was very angry and came out and shouted at the boys. How would be look if he was very angry?

Disgust: He has been given some food he doesn't like. He feels disgusted. He thinks "that's horrible, I can't eat that". How would he look if he was disgusted?

Interest: He is watching his favourite T.V. programme. He finds it very interesting. How would he look if he was interested?

Sadness: He has lost his pet dog. He feels sad because he might never see it again. How would he look if he was sad?

Happiness: He is at a party and there are lots of presents and lovely food. He is feeling happy. How would he look if he was feeling happy?

Surprise: He got a big box from the postman. When he opened it a jack-in-the-box jumped out and gave him a big surprise. How would he look if he was surprised?

The above order of stories was established by random selection and this was the order in which they were presented to the subjects for recognition of both male and female emotion.

Method:

The experiment took place in the 'story corner' of a large playroom. The subjects were not taken to another room to avoid any possibility of strangeness of surroundings affecting their performance. The 'story corner' was almost completely screened from the rest of the room, but to avoid visual distraction the child was seated with his back to the room and the sheets of photographs were placed, one at a time, on a table in front of him.

The child was seated slightly in front of the experimenter to ensure he could not pick up visual cues to aid his response. Once the child was seated a standard explanation was given: "I'm going to show you some photographs of people and tell you some stories and I'd like

you to point to the face which goes with each story. O.K.?" At this point the child usually nodded. The experimenter than went on: "Let's look at some ladies/men first", and placed the appropriate sheet of photographs on the table. If the child looked doubtful about what had to be done the procedure was explained again, and then the first story was told and the child asked to point to the face which went with it. When the first response was given the child was reassured that that was what was required.

Responses were noted on sheets prepared prior to the experiment (see Appendix 1). The name and sex of each subject was noted at the time of testing. The ages were obtained later from one of the Creche teachers.

Results:

The overall accuracy of recognition was 34% (Table III.1). This is much lower than the accuracy rate of around 50% reported by Izard (1971, p. 333) with 3 to 4 year olds. However, in the discrimination and recognition test used by Odom and Lemond (which involved both a form of emotion matching and recognition) the accuracy rate for the youngest group (5 to 8 year olds) was just below 50%. Even allowing for methodological and sample differences, it is difficult to explain the fact that Izard reports 3 to 4 year olds performing at the same level of accuracy as Odom and Lemond's 5 to 8 year olds. Part of the discrepancy may be due to the fact that Izard's results were not corrected for the 1-in-3 chance children had of being correct in identifying the photograph from the triad. In addition, Izard did not allow for the possibility that use of logical strategies (e.g. elimination of one known photograph) might have further increased the level obtainable by chance.

Table III.1: Correct identification of emotions in Pilot Study 1

Emotion	Photographs		
	Male	Female	Total
Happiness	5	7	12 (60%)
Disgust	3	6	9 (45%)
Sadness	1	6	7 (35%)
Anger	4	3	7 (35%)
Surprise	3	3	6 (30%)
Fear	4	1	5 (25%)
Interest	1	1	2 (10%)
	21	27	48 (34%)

Table III.2: Errors made in recognizing emotion in Pilot Study I

Emotion to be selected	Emotion selected						
	F	A	D	I	Sd	H	Sp
Fear (F)	-	2	5	1	3	1	3
Anger (A)	4	-	3	3	2	-	1
Disgust (D)	3	3	-	-	2	2	1
Interest (I)	-	2	4	-	1	6	5
Sadness (Sd)	1	8	-	-	-	1	2
Happiness (H)	3	1	-	-	-	-	4
Surprise (Sp)	2	2	2	3	1	4	-

Table III.3: Correct identifications: Sex of portrayer/Sex of subject in Pilot Study I

Sex of Subject	Sex of Portrayer	
	M	F
M (6)	12	18
F (4)	9	9

From Table III.3 it is apparent that girls were identifying male and female emotion equally accurately, while boys identified female emotion more accurately than male.

Discussion of Results and Implications for Main Study

Observations during testing, and the results obtained, encourage the conclusion that this method is suitable for use with young children. Subjects appeared to be quite at home with the methodology and a hierarchy of difficulty appeared: Happiness, Disgust, Sadness, Anger, Surprise, Fear, Interest.

Relationship with subjects: It became clear during testing that the fact that the experimenter had worked with the children for several mornings prior to testing was valuable. To begin the experiment, the child was asked to "come and look at some pictures". To ensure a representative sample some of the very shy children were approached. No child who was approached refused, but the shy children required a lot of persuasion and their eventual co-operation was perhaps only obtained because the experimenter was known to them.

Standardization of interaction with all subjects: Although it was intended that the verbal interaction with all subjects would follow a standard format, in practice this proved impossible. There were three main ways in which interaction moved from the intended course, and the following methods of dealing with them were applied.

1. Some subjects attempted to expand on the story. For example, after the fear story some children asked if it was a witch which had frightened the person. When such responses occurred a reply in the following form was given: "It might have been. How would she look if she was frightened by a witch?".

2. Some subjects needed considerable prompting before they would make a response. If no response was given after a long pause the child was prompted: "which one looks as though he was sad because he had lost his dog?". One child consistently replied "I don't know" after each story. However, on then being told "well just pick the one which looks most like how you think he would look" she went on to pick six photographs correctly (covering five emotions).

3. Some children attempted to give verbal responses - e.g. when asked how someone would look when she felt sad they would reply "As if she was crying". When such responses were given the child was then asked to pick the one which was crying because she was feeling sad.

Error Table: Due to the small numbers involved errors made in recognition of male and female portrayals of emotion are not presented separately. In the Main Study, however, the errors made in recognition of emotion in the male and female faces would be analysed separately.

Interest Story: Six children chose the Happiness faces for Interest. This may have been as a result of the story - children would assume that someone watching a favourite T.V. programme would be happy, and this may have over-ridden the word 'Interest' in the story. The use of a neutral face would also have had an effect. A more appropriate story would be: "You have been given an unusual animal and bring it in to show the teacher. The teacher was very interested in it and asked you all about it. How would she look if she was interested?"

Male portrayal of Anger: There were eight instances of Anger being picked for Sadness - five of them being identifications of male faces. In four cases the children who selected the Anger face instead of Sadness for the male correctly identified Sadness in the female, so they were not misunderstanding the story. Possible explanations are (1) the photograph was ambiguous; (2) children are not used to seeing males portraying Sadness; (3) Anger and Sadness expressions have common features and subtler differences which the children are not yet able to differentiate in male faces.

Disgust Story: Only Happiness was selected more accurately than Disgust. However, Izard (1971) reports Disgust was fifth in rank order of difficulty for 4 year olds. Other researchers have not included

Disgust in their experiments. The story may have helped increase accuracy by indicating that the person said "that's horrible". Honkavaara (1961) reports that children can describe faces in terms of action before they correctly associate the appropriate emotion, and that this is a manifestation of the young child's tendency to describe everything in terms of its function or action. When the pilot testing was finished, several children gathered round the test sheets and one pointed to the male Disgust face and said: "He's the one that's saying 'that's horrible'.". Another child pointed to the Happy face and said, "She's laughing". For the Main Study, therefore, an attempt will be made to match all the stories for the amount of facial/emotion 'action' they ascribe to the actor in the story.

Practice/order effects: There was no indication that children were performing better on the second set presented - however, it was decided to retain the half male/female and half female/male order in the Main Study.

Table III.4: Correct identifications: Order of presentation of male and female sets in Pilot Study I

	Set presented first		
	Male	Female	
Number of correct identifications of female emotion	12	15	(27)
Number of correct identifications of male emotion	9	12	(21)

From Table III.4 it is seen that female emotions were more accurately recognized irrespective of whether they were the first or second set presented.

Spearman's Rank Order Correlation was calculated between the order in which the emotions were identified and the accuracy with which they were recognized. The order of presentation of the

emotions did not have a significant effect. Within each sex (of portrayers) where was no indication that order of identification of emotions had an effect - Surprise, for example, was the last emotion to be identified and only ranked fifth in the accuracy scores. Nor did position of emotion on the sheets have an effect: e.g. Surprise was correctly selected on three occasions for males and on three occasions for females, although on the female sheet it was the first on the left. Happiness was first on the left of the male sheet, yet was accurately selected five times for the male and seven times for the female.

PILOT STUDY II: To establish suitability of portrayals of emotion by a single male and a single female actor and to establish if young children could match photographs on the basis of emotion portrayed.

Purpose:

(1) To establish whether using portrayals of emotion by a single male and a single female actor would make the emotion recognition task easier (in contrast to Pilot Study I where different actors were used).

(2) To test ability of subjects to match photographs on the basis of emotion expression. It was hoped comparison of this matching score with recognition score would indicate whether the subjects could extract the relevant information to match photographs on the basis of emotion. If they could 'match' certain emotions, yet not accurately select them in the recognition experiment, this may indicate that ability to extract and process the relevant information was not a sufficient condition for correctly identifying an emotion expression.

Subjects:

Sixteen children (eight boys and eight girls) at the Staff/Student Creche of Queen's University were tested. The youngest child was 3 years 5 months and the oldest child 5 years 2 months. The average age of the group was 4 years 3 months (average age of girls: 4 years 5 months, average age of boys: 4 years 0 months).

Materials:

1. Emotion Recognition: (1) Photographs: As noted above, it was hoped that using just one male and one female actor would make the emotion recognition task easier. From the book by Ekman and Friesen (1975) it was possible to extract photographs of portrayals of 'full' and 'pure' expressions (as defined by Ekman and Friesen) of Anger, Disgust, Fear, Happiness, Sadness and Surprise by one male and one female. It was thus decided to use this set and drop Interest from the investigation. The following photographs were thus selected:

Anger: p. 91, Fig. 37
p. 124, Fig. 57A

Disgust: p. 75, Fig. 29B
p. 76, Fig. 30 (right photo)

Fear: p. 62, Fig. 22

Happiness: p. 104, Fig. 43
p. 105, Fig. 44

Sadness: p. 127, Fig. 60

Surprise: p. 45, Fig. 11

Layout: Two criteria were applied (i) no photograph should be in the corresponding position to the order in which the emotion was to be identified, e.g. Happiness was not the first on the left. (ii) No emotion was in the same position on the male and female sheets.

Male:	Surprise	Sadness	Disgust
	Fear	Happiness	Anger
Female:	Disgust	Fear	Happiness
	Sadness	Anger	Surprise

Presentation: As in Pilot Study I, in half the trials male faces were presented first, and, in half, female first.

(2) Stories: The stories were re-written to make them more realistic in terms of adult emotion. An attempt was also made to ensure that a similar amount of emotion reaction was ascribed to the 'actor' in each story. The amended stories were as follows:

> Anger: Some children were playing ball and they kicked their ball through his/her window. He/she was very angry and came out and shouted at the children. How would he/she look if he/she was angry?
>
> Disgust: He has been given some food he doesn't like. He feels disgusted. He thinks "that's horrible, it would make me sick". How would he look if he was disgusted?
>
> Fear: He was walking down a dark street and he heard a very strange noise behind him. He turned round and saw what looked like a ghost. He began to shake and felt afraid. How would he look if he was afraid?
>
> Happiness: He was at a party and there were lots of presents and lovely food. Everyone was laughing and having fun. He was feeling happy. How would he look if he was feeling happy?

Sadness: His little boy is lost. He felt sad because he might never see him again. He left like crying. How would he look if he was feeling sad?

Surprise: He was going to take the dog for a walk and went to the cupboard to get the lead. His children were hiding in the cupboard and they jumped out and surprised him. How would he look if he was surprised?

Method:

To avoid the possibility of recognition scores being affected by familiarity with the photographs produced during matching, and to ensure that for the matching experiment the children would already be used to scanning the photographs, each child was presented first with the recognition task and then with the matching task.

Emotion recognition: The procedure used was identical to that in Pilot Study I. To make the task as easy as possible the order in which the emotions were to be identified was the order of difficulty established in Pilot Study I - Happiness, Disgust, Sadness, Anger, Surprise and Fear.

Emotion matching: After recognition had been tested on both male and female sets each child was given a male and female set of photographs, identical to those on the recognition sheets, and instructed to "put each photograph beside the one which it is the same as". Whether the child was asked to match male or female faces first depended on which emotion recognition set he had just completed. Thus:

	Emotion recognition		Emotion matching	
	1st	2nd	1st	2nd
Sex of portrayer	M F	F M	M F	F M

Results:

Emotion Recognition

Examining first the recognition scores, it can be seen from Table III.5 that the 'order of difficulty' established in the first Pilot Study was not fully confirmed by the result of this study,

though the small number of subjects involved may account for this. Disgust moved from 2nd to 5th place: there was, however, quite a large discrepancy between accuracy of recognition of Disgust in the male (25%) and in the female (56%). It may thus be the case that for very young children the 'order of difficulty' should be considered separately for male and female portrayals of emotion.

Table III.5: Correct identification of emotions in Pilot Study II

Emotion	Male Photo	Female Photo	Total
Happiness	13	9	22 (69%)
Sadness	10	10	20 (63%)
Anger	8	8	16 (50%)
Surprise	7	9	16 (50%)
Disgust	4	9	13 (41%)
Fear	5	3	8 (25%)
	47	48	95 (49%)

Turning now to sex of subject, it is apparent from Table III.6 that girls performed better than boys. The average score for girls was 7 correct identifications, while the boys scored an average of 5. However, the average age for girls was 4 years 5 months while that for boys was 4 years 0 months.

Table III.6: Correct identifications: Sex of Portrayer/Sex of Subject in Pilot Study II

	Sex of portrayer	
	M	F
Boys (N = 8)	22	19
Girls (N = 8)	25	29
	47	48

Table III.7: Correct identifications: Order of presentation of male and female sets in Pilot Study II

Order of Presentation	Boys: Average Age (yrs mths)	Boys: No. of correct identifications M	Boys: No. of correct identifications F	Girls: Average Age (yrs mths)	Girls: No. of correct identifications M	Girls: No. of correct identifications F	Total
Male First	4 3	16	10	4 5	14	16	56
Female First	3 8	6	9	4 6	11	13	39

Although from Table III.7 it would appear that presentation of the male set of photographs first results in more accurate recognition of emotion, the children who received the male set first were older than those who received the female set first. The ages of the children were not obtained until after the experiment was complete, and this resulted in the imbalance.

Table III.8: Errors made in recognizing emotion in Pilot Study II

Emotion to be selected	Emotion selected: H	D	Sd	A	Sp	F
Happiness (H)	-	1	3	1	2	3
Disgust (D)	2	-	4	7	1	5
Sadness (Sd)	1	5	-	4	1	1
Anger (A)	-	8	2	-	1	5
Surprise (Sp)	3	1	2	5	-	5
Fear (F)	2	1	3	7	11	-

From Table III.8 it can be seen that confusion between Surprise and Fear is the most common error in the recognition experiment - 16 of the errors made were of Fear for Surprise or Surprise for Fear. Overall, however, in this Pilot Study discrimination of Surprise and Fear was increased (in comparison with Pilot Study I) with accuracy of recognition reaching 50% for Surprise.

Emotion matching

When children were asked to match faces on the basis of emotion expression by placing each photograph beside the one it was the same as, overall accuracy reached 65%. Male and female faces were matched with almost equal accuracy (Table III.9).

Table III.9: Correct matching of emotion in Pilot Study II

Emotion	Male Face	Female Face	Total
Happiness	13	12	25 (78%)
Disgust	10	13	23 (72%)
Sadness	10	12	22 (69%)
Anger	9	11	20 (62%)
Surprise	11	7	18 (56%)
Fear	10	7	17 (53%)
	63	62	125 (65%)

From Table III.10 it can be seen that boys and girls performed the matching test equally well. There was no evidence of a sex of portrayer/sex of subject interaction.

Table III.10: Correct matchings: Sex of portrayer/Sex of subject in Pilot Study II

	No. of correct matchings	
	M	F
Boys (N = 8)	32	30
Girls (N = 8)	29	34

Table III.11: Correct matchings: Order of presentation of male and female sets in Pilot Study II

	No. of correct matchings		
	M	F	Total
Male First	35	38	73
Female First	26	26	52

Table III.11 shows that, as in the recognition experiment, the older children who had had the male set presented first performed best.

Table III.12: Errors made in matching emotions in Pilot Study II

Emotion on stimulus sheet	Emotion matched					
	H	D	Sd	A	Sp	F
Happiness (H)	-	1	3	1	-	-
Disgust (D)	-	-	2	4	2	1
Sadness (Sd)	3	1	-	3	1	3
Anger (A)	-	3	2	-	3	4
Surprise (Sp)	2	1	1	1	-	7
Fear (F)	2	3	1	3	5	-

From Table III.12 it can be seen that, as in the recognition experiment, Surprise and Fear were confused. Due to the small numbers involved it is not possible to accurately identify other common confusions.

Discussion

Emotion recognition: In Pilot Study I the overall accuracy rate was 34% and in Pilot Study II it was 49%. The children in the second study were, however, slightly older than the children in Pilot Study I, so it is not possible to determine how much of the increase in accuracy is due to age and how much to use of only a single portrayer of each sex. However, having only six photographs to scan (of a single portrayer in each case) resulted in the children making their choices more rapidly (though again age may be having an effect). In Pilot Study I testing took from 10 to 20 minutes for each subject, the average being 12-15 minutes. In Pilot Study II the recognition task was completed in 5 to 10 minutes with most children completing it in approximately 5 minutes.

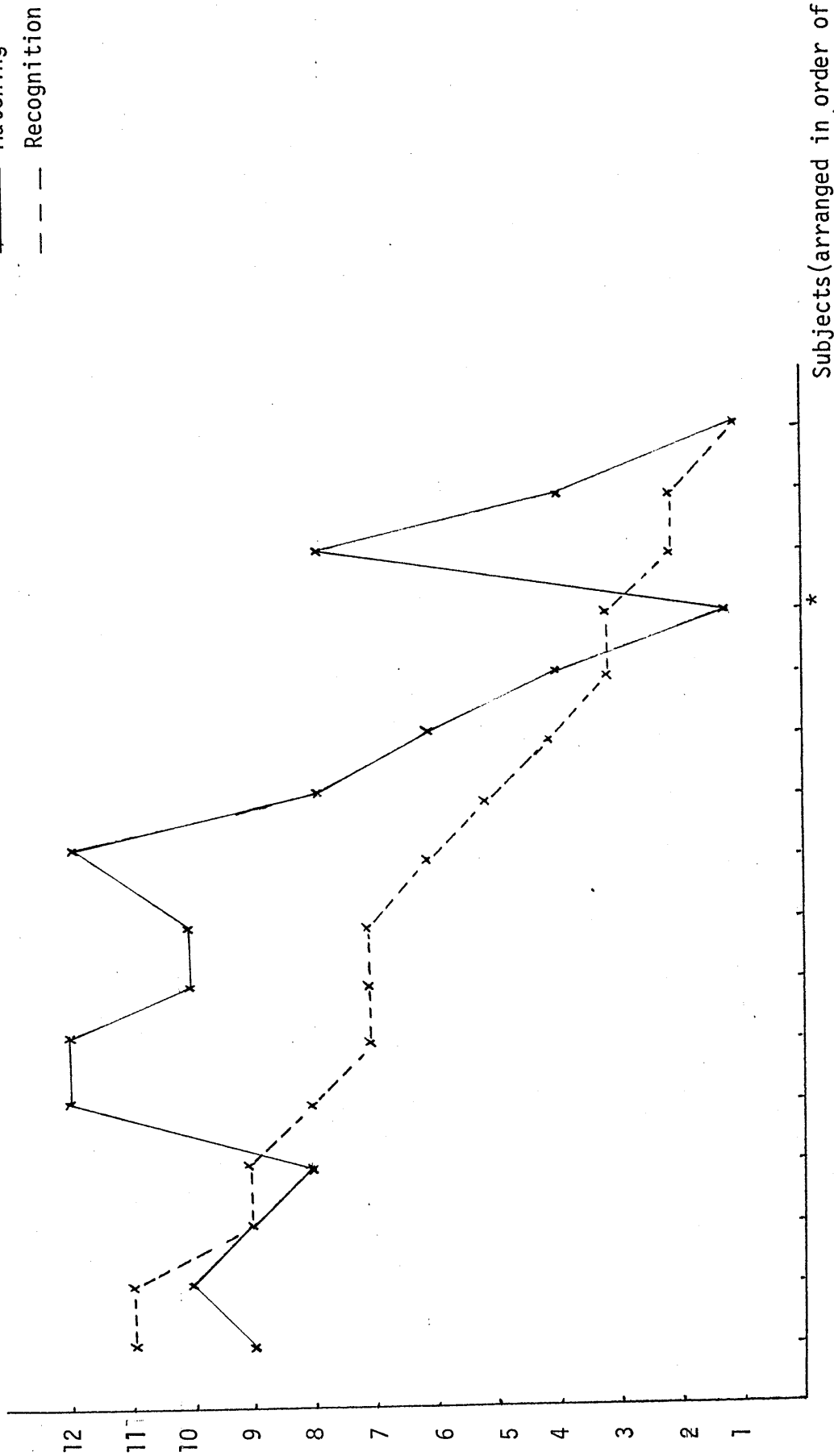
Emotion matching: The 'order of difficulty' which emerged from the emotion matching experiment was identical to that found in Pilot Study I for emotion recognition. The only problem encountered with the procedure was that when the child had matched five emotions, and had only one photograph left, he often realized that the photograph left did not match the only stimulus photograph not yet matched. When this occurred the child was allowed to correct a previous mistake if he could see it, and the corrected matching was scored.

Three children got perfect scores on the matching experiment, and three children made only one error (i.e. confusing two emotions). Of children who only confused two emotions on either the male or female sets, five of the confusions were of Fear/Surprise, two of Disgust/Anger and one of Sadness/Anger - these are also common confusions on the recognition experiment.

Comparison of Matching and Recognition Scores: Overall accuracy on the recognition task was 49%, whereas accuracy on the matching task was 65%. As can be seen from Fig. III.1, only four children got poorer scores on matching than on recognition. One of these children had a severe squint which may have made visual comparison difficult. The other three children had matching scores only one or two below their recognition scores, whereas the greatest positive deviation between matching and recognition scores was six.

Three children obtained perfect matching scores (i.e. 12) and recognition scores of 8, 7 and 6, thus indicating that young children can cope with the tasks. These results suggest that children may be capable of matching emotion expressions before they can correctly associate the appropriate emotion, as conveyed by the story, with the appropriate configuration.

Fig. III.1: Comparison of scores on recognition and matching in Pilot Study II



* This child had a severe squint and is slightly retarded.

PILOT STUDY III: To establish if it was possible to develop a group test of emotion recognition

Purpose:

Individual testing of large numbers of children is extremely time-consuming and imposes a great deal of disruption on schools. Pilot Study III set out to test the practicability of group testing. Since there were no reports in the literature of group testing of emotion recognition with children a procedure had to be devised.

Subjects:

An urban working class school in Belfast was selected. It was considered that P3 would be the youngest class capable of handling the task in the group form. There were nineteen children (six girls and thirteen boys) present in P3 on the day of testing. Their ages ranged from 6 years 10 months to 8 years 0 months. The average age was 7 years 5 months (average age for boys 7 years 6 months, average age for girls 7 years 3 months). The class contained four Chinese children.

Materials:

(1) Photographs: Each child was given a set of three sheets of photographs (Appendix 2). The first sheet was a practice sheet showing six different kinds of people (e.g. a policeman, a judge). The photographs were numbered 1 to 6. The second and third sheets were photocopies of the layout of male and female expressions of emotion used in Pilot Study II. These too were numbered 1 to 6.

(2) Response sheet: Each child was given a response sheet (see Appendix 3).

(3) Stories: The stories were those used in Pilot Study II and were read to the class.

Procedure:

After being introduced by the class teacher the following instructions were read. Elaboration was given when the children seemed

unsure of what had to be done, or if some children seemed inattentive. Throughout testing, the children were reminded to keep their answers hidden from their neighbours. The instructions were:

> "I've got something interesting for you to do this morning. I've brought some photographs for you to look at. You see they are of different kinds of people. Look at yours. You see the first one? What is this person doing? ... (Yes he's writing or drawing). You see the number above it? What number is that ... (Yes it's No. 1). Now look at the second one. What is this person doing do you think? (Yes she's talking on the phone). And what's the number above that. (Yes it's No. 2). Now look at the next one - it's number three isn't it. And what's the next number (yes, it's No. 4). Have a good look at the person in it. Now look at the next one - what number is that (that's right No. 5). Now look at the last photo - what number does that have. (Yes, that's right, it's a six.)
>
> Now look up - I'm going to tell you a little story. Are you all listening?
>
> Paul lost his dog. He went to the police station to tell the policeman. That night there was a knock at the door. Paul went to answer it. There was a policeman there with his dog. Now who was the person who brought the dog back?
>
> Don't call out the answer - that's not allowed. Look back at the photographs. You see the first one (No. 1) was that the person who brought the dog back? Look at No. 2 do you think it was that person who brought the dog back. You see you have to look at all the photographs carefully and decide. Look carefully at all the photographs and decide which one brought the dog back. Don't call out the answer - just keep it to yourself. Now find the number above it. Put the number of the photograph down on your sheet. You see where it says A - put the number down beside it.
>
> What did you get? (That's right a 4). Four is the number of the photograph of the policeman."

At this point a check was made to ensure all the children had got the correct answer, and were noting it down in the correct space. The instructions continued as follows:

> "Now we are going to do exactly the same thing with some other photographs. Turn over the page to the photographs of the lady. I am going to tell you some stories about how she feels, and after I have told you each story I want you to look at all the photographs and write down the number of the photograph that shows how she feels in the story. Remember this is not a test, but when you have decided which photograph goes with the story don't point to it in case your neighbour sees."

The first story was read and a further instruction added:

> "Now look carefully at all the photographs - while you are making up your mind I'll read the story again ... Now you must write down the number in the space beside the B ... Has everyone finished? Now here is the next story ..."

Testing continued in this way until all the female faces had been identified. When the first few male faces had been identified some signs of restlessness appeared. Since the children had grasped the procedure well it was decided to speed the process up and the stories were read once only.

When testing was finished the children were instructed to write their names on the response sheet. Their ages were obtained later from the class register.

Results:

As can be seen from Table III.13 overall accuracy of recognition of emotion reached 73%. Recognition of the individual emotions varied, with recognition of Happiness reaching almost 100%.

Table III.13: Correct identification of Emotions in Pilot Study III

Overall accuracy of recognition	73%
Recognition of female emotion	85%
Recognition of male emotion	61%

Emotion	Male Photos	Female Photos	Total
Happiness	18	19	37 (98%)
Disgust	15	19	34 (89%)
Sadness	9	17	26 (77%)
Anger	8	16	24 (71%)
Surprise	9	13	22 (65%)
Fear	10	13	23 (68%)
	69	97	166

Table III.14 shows that boys and girls performed equally well, and that female portrayals of emotion were more accurately recognized than male portrayals.

Table III.14: Correct identifications: Sex of Portrayer/Sex of subject in Pilot Study III

	Correct identifications		
	M	F	
Girls (N = 6)	22 (43%)	29 (57%)	(Average score 8.5)
Boys (N = 13)	47 (41%)	68 (59%)	(Average score 9.0)

Twelve children obtained perfect scores on female faces and four children obtained perfect scores on male faces. From Table III.15 it can be seen that the errors made reflect those found with younger children, with the Surprise/Fear confusion accounting for most of the errors.

Table III.15: Errors in recognition of emotion in Pilot Study III

Emotion to be identified	Emotion selected					
	H	D	Sd	A	Sp	F
Happiness	-	1	-	-	-	-
Disgust	-	-	2	-	-	1
Sadness	-	1	-	9	1	1
Anger	-	2	7	-	1	4
Surprise	6	1	-	1	-	8
Fear	-	-	-	-	15	-

Discussion:

The results show that group testing of emotion recognition in children is possible. No difficulties were encountered with the procedure. The children understood the instructions and appeared to enjoy the task. There was, however, a large discrepancy between accuracy of recognition of male and female emotion. Results with

younger children did not show such a discrepancy, which would suggest that for younger children the sets of photographs were of equal difficulty. Two explanations are possible (1) response fatigue and (2) working class children are less used to seeing male emotion (children in Pilot Studies I and II were of upper middle class status). During testing of the recognition of male emotion the children became restless and testing was speeded up - this too may have had an effect. Response fatigue was a factor in the present Pilot Study. To avoid this in subsequent testing the story was only read once, with the instruction then being given in the form of "now look for the face which is Happy, find the number above it and write it in the space beside the A".

There was an indication of a possible problem with the Surprise story. For Surprise, the Happy face was chosen six times and the Fear face nine times. It may be that the story encouraged children to regard the incident as a 'happy surprise' or, alternatively, as something frightening. To avoid this in succeeding testing, stress was laid on the emotion to be selected rather than repeating the story.

All the errors made when the Fear face should have been selected were of Surprise being chosen. This accounted for 24% of the total errors. In order to ensure that the story is not helping to produce this effect it was decided to change the story to "he saw something coming out of the shadows", without specifying what it was. Older children, particularly, may regard seeing a ghost as surprising rather than frightening.

Within the class there was no age trend - in fact the youngest child in the class produced a perfect score. The two poorest scores (only 4 correct judgments) were made by two of the Chinese children. According to their teacher language difficulties may have resulted in

their not understanding the instructions or stories - it may, however, be that the scores of such children could be increased if individual testing was used.

PILOT STUDY IV: To establish if recognition of emotion in parts of the face could be tested in group form

Purpose:

To ensure the number of subjects could be as large as possible a group test of children's ability to recognize emotion in the whole face had been developed and tested in Pilot Study III. It was considered desirable that group testing of recognition of emotion in parts of the face should, if possible, be developed. The photographs used in the previous Pilot Studies were cut through the nostrils, and several adults and children were informally tested. It became clear that judgments could be made from just part of the face. The following study was carried out to establish if a group test of recognition of emotion in parts of the face could be used with children.

Subjects:

It was judged that P4 were the youngest group which could handle this task. An urban working class school in Belfast was selected and there were 21 children present on the day of testing - 12 boys and 9 girls. There were 7 Chinese children in the class. The average age of the class was 8 yrs. 0 mths. (average age of girls: 7 yrs. 10 mths, average age of boys: 8 yrs. 1 mth.)

Materials:

The photographs of male and female portrayals of emotion used in the previous Pilot Study were, according to Ekman and Friesen, full portrayals of each emotion. However, it would be unwarranted to assume that for any particular emotion the intensity of the portrayal by the male and female would be identical in each area of the face. It was therefore decided that only the female face would be used for the 'parts' task. The female face was chosen in preference to the male because (1) in previous Pilot Studies female emotions had been identified slightly more accurately than male and, (2) due to the skin tones the photograph of the female portraying Disgust showed the wrinkling of

the nose more clearly than the photograph of the male when reproduced. Since the nose area would be presented alone for identification it was considered important that the sets of 'parts' photographs should be as clear as possible.

In the first individual pilot testing of children's ability to recognize emotion in parts of the face, the photographs had been cut through the nostrils - identification was thus taking place on the basis of the upper and lower face. However, it was realized that for Disgust the wrinkling of the nose was a vital clue and, for example, that it was possible to recognize Anger from the flaring of the nostrils. It was thus decided that the face would be divided into three sections. The first cut was made below the lower eyelid and the second cut was made through the nostrils.

Layout of photographs: Each set of six photographs was arranged at random - while making sure that no emotion was in the same position on more than one sheet. The following layout of photographs was obtained.

Mouths:	Sadness	Fear	Anger
	Surprise	Happiness	Disgust
Eyes:	Happiness	Disgust	Surprise
	Fear	Anger	Sadness
Noses:	Anger	Surprise	Happiness
	Sadness	Disgust	Fear

Sets of parts photographs were then prepared, with mouths on the first sheet, eyes second, and the noses last (Appendix 4). It was decided that the mouths should be tested first, since it was considered the Happiness mouth would be easily recognized, thus supplying an easy and reassuring introduction to this part of the task.

Response sheet: A response sheet was prepared (Appendix 5) and attached to the back of the response sheets for the Whole face test.

Stories: The stories were those used in the previous group study, with the new Fear story added.

Method:

Recognition of emotion in the whole female face was tested first, so that recognition of emotion in the male face would be tested between recognition of emotion in the whole female face and the parts of the female face, to reduce any possible memory effects. Thus the original intention to systematically vary the order in which the male and female sets were presented for judgment had to be abandoned for group testing.

The whole face photographs and response sheets were distributed and the instructions given for completing recognition of emotion in the whole face as before.

The whole face photographs were then collected to ensure comparisons could not be made with the parts photographs. The parts photographs were then distributed and the experimenter continued:

> "Now we are going to do something slightly different. Turn over to the answer sheet that has columns marked Mouths, Eyes and Noses. Now look at all the mouths on the first page of photographs. They are labelled 1, 2, 3, 4, 5 and 6, just the way the whole faces were. Have a good look at each one. We are going to do exactly the same thing as we did with the whole faces - I will remind you about the story and you write down in the space I tell you the number of the photograph you think shows how the person was feeling in the story. Here is the first story: she was at a party and feeling very happy - find the mouth of the person who was feeling happy and write the number of it in the space beside the 1. in the Mouths column." (This was indicated.)

Testing continued in this format with the children being reminded of the stories as follows:

- Disgusted because she was given something horrible to eat.
- Sad because her little boy was lost.
- Angry because someone broke her window.
- Surprised because her children jumped out of the cupboard.
- Frightened because she heard a noise behind her when walking down a dark street.

Instructions for completing recognition of emotion in the eyes were given as follows:

> "Now we are going to do the same thing with some eyes - so turn over the page to the photographs of the eyes and see if you can find the eyes of the person who was happy because she was at a party. Write down the number of the photograph in the space beside the 1. in the eyes column."

Testing was continued as above with the other five emotions.

> "Now we are going to try to do the same thing with some noses - turn over to the noses - these are very difficult aren't they - but just let's see if we can get some of them. See if you can find the nose of the person who was happy at a party and write down the number in the space beside the 1. in the noses column."

Testing was continued as above with the other five emotions.

The children were then asked to write their names on the front of their response sheets. Their ages were obtained from the class register.

Results:

Recognition of emotion in the whole face

Table III.16: Accuracy of recognition of emotion in the whole face in Pilot Study IV

Overall accuracy: 77%
Recognition of female: 82%
Recognition of male: 73%

Accuracy of recognition of each emotion

Emotion	Male photo	Female photo	Total
Happiness	21 (100%)	21 (100%)	42 (100%)
Disgust	18 (91%)	18 (91%)	36 (91%)
Sadness	11 (47%)	18 (91%)	29 (68%)
Anger	9 (39%)	17 (86%)	26 (62%)
Surprise	16 (81%)	14 (66%)	30 (73%)
Fear	16 (81%)	13 (61%)	29 (71%)
	91 (73%)	101 (82%)	192 (77%)

As can be seen from Table III.16, the order of difficulty which emerged in this study for female portrayals of emotion was the same as that established in the previous Pilot Studies: Happiness, Disgust, Sadness, Anger, Surprise and Fear. Happiness and Disgust remained the two emotions most easily identified in the male, but the other four emotions appeared in a different order of difficulty. Since the numbers involved are small, it would be unwise to draw any firm conclusions. However, it may be that as accuracy overall increases the order of difficulty becomes less pronounced - i.e. when totals for male and female portrayals are added together, only 9% separates the rates for Sadness, Anger, Surprise and Fear.

Surprise and Fear were recognized very accurately in the male (81%) - though not in the female. The rates obtained for Fear and Surprise in the male were unexpectedly high. It may be that these are considered more appropriate emotions for the male, and perhaps they can be seen more often in T.V. programmes and/or real life.

Boys and girls performed almost equally, though the boys were slightly older (Table III.17). There was no evidence of a sex of portrayer/sex of subject interaction.

Table III.17: Correct identifications: Sex of Portrayer/Sex of Subject in Pilot Study IV

	Sex of Portrayer		
	M	F	
Girls (N = 9)	36	45	(average score 9)
Boys (N = 12)	55	56	(average score 9.25)

From Table III.18 it can be seen that Anger was picked 7 times for the male, and once for the female, when Sadness was the emotion to be identified. When Anger was the emotion to be picked, Sadness was selected 5 times for the male - children obviously find it difficult to differentiate between Anger and Sadness in the male.

Table III.18: Errors made in recognition of emotion in the whole face in Pilot Study IV

Emotion to be selected	Emotion selected					
	H	D	Sd	A	Sp	F
Happiness (H)	-	-	-	1M	1F/3M	1M
Disgust (D)	-	-	-	2F/2M	1F/1M	-
Sadness (Sd)	-	3F/2M	-	5M	1M	1M
Anger (A)	-	1M	1F/7M	-	-	1F
Surprise (Sp)	-	-	1M	2M	-	5F/3M
Fear (F)	-	-	2M	2F/2M	4F	-

M = errors made in male face
F = errors made in female face

Surprise and Fear, as noted above, were identified very accurately in the male - much better than in the female. However, Surprise and Fear remain the most common confusion.

Difficulty in discriminating between Anger and Disgust in the male was responsible for the very low accuracy rates for these two emotions. Five children made this error as their only error in judging male emotion.

Recognition of emotion in parts of the face

As can be seen from Table III.19, emotion was most accurately identified from the mouths and least accurately identified from the noses. Table III.20 shows that for the individual emotions, the area from which most accurate judgments were made varied.

Table III.19: Accuracy of recognition of emotion in parts of the face in Pilot Study IV

	Boys	Girls	Total
Accuracy rate for mouths	47 (65%)	33 (61%)	80 (63%)
Accuracy rate for eyes	39 (54%)	27 (50%)	66 (52%)
Accuracy rate for noses	14 (19%)	18 (33%)	32 (25%)
Combined			178 (47%)

Table III.20: Recognition of each emotion in parts of the face in Pilot Study IV

Emotion	Mouths	Eyes	Noses	Combined
Happiness	21 (100%)	13 (61%)	11 (47%)	69%
Disgust	13 (61%)	8 (38%)	15 (70%)	57%
Sadness	17 (86%)	10 (42%)	2 (10%)	45%
Anger	14 (65%)	14 (65%)	0 (0%)	44%
Surprise	10 (42%)	11 (47%)	4 (19%)	36%
Fear	9 (38%)	11 (47%)	3 (14%)	33%
				47%

In mouths, Happiness was the easiest emotion to identify (100%) and this, if found generally, may suggest that Frijda's model of emotion recognition (that pleasant/unpleasant is the first judgment made) may be correct. Sadness was the emotion next easiest to identify from the mouth alone.

The Anger eyes were the easiest to identify, and in noses Disgust was the emotion most accurately identified. The high rate for Happiness in the noses is probably accounted for by the fact that when the Happiness photograph was cut through the nostrils the folds (which have been drawn up in a smile) around the nose are visible. It would be artifical to remove these, and it is interesting to note that Happiness was identified from this region alone.

As in judging emotion in the full face, the most common confusions in judging mouths were between Surprise and Fear, and Anger and Disgust (Table III.21). In the eyes the most common confusions were between Surprise and Fear (though less than with the mouths) and Disgust and Sadness (which were not confused at all in judging mouths alone). Even though Disgust was identified with such accuracy in the nose it did not prevent Disgust being incorrectly chosen for other emotions.

Table III.21: Errors made in recognition of emotion in each part of the face in Pilot Study IV

	Emotion Selected	Emotion to be identified					
		H	D	Sd	A	Sp	F
Mouths	H	-	-	-	-	-	-
	D	-	-	3	5	-	-
	Sd	-	-	-	1	1	2
	A	-	6	-	-	1	-
	Sp	1	2	-	1	-	7
	F	-	-	1	1	9	-
Eyes	H	-	5	-	-	3	-
	D	1	-	6	4	2	-
	Sd	2	5	-	-	4	-
	A	-	2	2	-	3	-
	Sp	1	1	1	1	-	7
	F	1	1	2	1	4	-
Noses	H	-	3	1	2	-	4
	D	2	-	3	-	-	-
	Sd	-	3	-	-	8	7
	A	2	4	5	-	1	6
	Sp	6	1	3	5	-	2
	F	3	-	2	10	2	-

H = Happiness
D = Disgust
Sd = Sadness
A = Anger
Sp = Surprise
F = Fear

Discussion:

No difficulties were encountered during testing - and the task was completed in 45 minutes. The children remained interested in the task throughout and co-operated fully. Some children at the beginning of the task tried to compare answers, but they stopped doing this when the experimenter reminded them that she wanted to know what

each child thought. A careful watch was kept throughout testing to ensure comparison of answers did not recur. Shortly after testing began a child asked if a face could be picked more than once. The experimenter confirmed that it could. This instruction was added for the Main Study.

The children enjoyed recognition of emotion in parts of the face. They found seeing six pairs of eyes, six noses and six mouths amusing, but nevertheless took the task seriously. One or two children expressed concern that they did not know a particular answer - when this occurred they were instructed just to leave a space, or put a stroke against the space.

Conclusion:

On the basis of this small sample it appears that the area of the face from which emotion is most easily identified depends on the emotion:

Happiness - mouth

Disgust - nose

Sadness - mouth

Anger - eyes and mouth equally

Surprise and Fear - the eyes are slightly superior

The success of this experiment with P4 children encouraged the view that P3 children would also cope successfully with the procedures. Accordingly in the Main Study group testing of recognition of emotion in the whole face and in parts of the face was used from P3 upwards.

CHAPTER IV: THE MAIN STUDY

INTRODUCTION

The purpose of the present study is to investigate the development of children's ability to recognize facial emotion. Five areas will be investigated:

1. Emotion Recognition: As noted in Chapter II, Gates (1923) reported an age-related increase in accuracy of emotion labelling among 3 to 13 year old children. Izard (1971) reported an age-related increase in accuracy of both labelling and recognition of emotions among his 2½ to 9 year old subjects. Ekman and Friesen (1971), however, reported that there was no significant difference in accuracy of recognition of emotion between a group of 6 to 7 year olds and a group of 14 to 15 year olds. This study will thus first examine the relationship between age and emotion recognition ability, and an attempt will be made to establish if the ability to recognize facial emotion does increase with age. The relative difficulty of recognition of the six basic emotions in both the male and female face will be examined: whether, for example, Happiness is more accurately recognized than other emotions by children of all ages. On the basis of Pilot Study findings it is predicted that among young children there will be an 'Order of Difficulty' - Happiness, Disgust, Sadness, Anger, Surprise, Fear. Tomkins and McCarter (1964) report that in their emotion labelling experiment with adults 'common confusions' occurred. In the present study, therefore, the errors children make in recognition of emotion will be examined to identify any emotions systematically confused, and whether the type of errors made changes with age. It is predicted that as age increases, and children become more familiar with emotion expressions, the errors made will become less random.

2. Emotion Matching: Izard (1971) drew the distinction between emotion labelling (where the child is asked how the person in the stimulus photograph is feeling) and emotion recognition (where the child selects one photograph from a triad in response to being

asked e.g. which person is feeling sad). The recognition task occurs, he suggests (p. 325), by the child matching the verbal description to the photograph: "This matching process, presumably, is mediated by subjective experience, or by memory of a subjective experience, and its associative network of cognitions (labels or words and phrases)."

In the present study, however, the emotion matching task consisted of matching a set of portrayals of the six basic emotions to an identical set placed on the table. Children's ability to match faces portraying the six basic emotions had not been examined by other researchers. The present study will therefore investigate the relationship between age and ability to match faces on the basis of emotion portrayed. The 'Order of Difficulty' of matching emotions will be examined and compared to that found for emotion recognition. If, as expected on the basis of the Pilot Study results, the Order of Difficulty for matching and recognition are not the same, then it would be reasonable to speculate that different processes are involved in recognition and matching. The errors children make in matching emotions will then be examined to identify any emotions systematically confused, and if the types of error made change with age.

3. The Relationship between Recognition Ability and Matching Ability: The relationship between accuracy of matching emotions and accuracy of recognition of emotions will be analysed (1) to establish if emotions are more accurately matched than recognized at each age, and (2) to investigate how accuracy of recognition and matching vary. It is hoped that examination of the relationship between emotion matching and recognition abilities (including, as noted above, the Order of Difficulty in each case) will provide an insight into how young children begin to learn about facial expressions of emotion. If, for example, emotions are always more accurately matched than recognized, it is justifiable to conclude that the ability to analyse the configuration which denotes a specific emotion is a necessary, though not sufficient,

condition for recognition of emotion - i.e. failure to recognize is not merely failure to scan and analyse the face.

4. Factors related to development of Ability to Recognize Facial Emotion: In recognition of emotion studies with children, few biographical or personality factors have been examined and related to accuracy of recognition scores. In an attempt to begin to identify factors which are related to the development of the ability to recognize facial emotion, the relationship between accuracy and the following will be investigated:

Social Class: Izard (1972) found that accuracy of recognition and labelling of emotion increased with socio-economic level. The finding of Schmidt and Hore (1970), that middle class mothers looked more often at their children and reciprocated more of their glances (in addition to, as noted by Bernstein, 1973, using a more elaborate verbal code), suggests that middle class children may have better opportunities to learn about the meaning of facial expressions. On the basis of such evidence it is hypothesized that middle class children will recognize emotion more accurately than working class children.

Birth Order and Number of Siblings: It is hypothesized that since it is reasonable to conclude that first born and 'only' children may have more interaction with the mother, they hence have more opportunities to learn about facial expressions from the most significant 'other' in their environment. It is recognized that many other factors may affect the amount, or the quality of, the interaction between mother and child (e.g. full or part-time employment), but this is outside the scope of the present research.

Sex of subject: The findings of previous research are contradictory. As discussed in Chapter II, Borke (1971) reported no sex differences in empathy, but in 1973 reported finding girls

superior; Gates (1923) reports girls superior in emotion labelling at 4, 5 and 9 and boys superior at 5, 6, 7 and 8 (her results for age 5 are ambiguous). Buck (1975) found that the sex differences identified in studies with adults were not present in his study with children. However, Buck's study was confined to fifteen 4 to 6 year olds. In the present study it is hypothesized that girls will recognize emotion more accurately than boys.

Popularity of Subject with Peers: As noted in Chapter II, Buck (1975) found the ability to 'send' emotion messages was positively related to the child being extravert and having many friends at school. The relationship between emotion recognition and popularity has not been investigated in children, though adult studies (e.g. Buck, Miller, Savin and Caul, 1974) would suggest it is the 'introvert internalizer' who would recognize emotion most accurately. Since being able to recognize emotion in others is a prerequisite for being a successful interactor, in the present study it is hypothesized that there will be a positive correlation between emotion recognition ability and popularity.

Extraversion and Neuroticism as measured by the Junior Eysenck Personality Inventory: As noted above, studies with adults had suggested that there were 'extravert externalizers' who were good 'senders' of emotion messages, but poor recognizers of emotion in others, and 'introvert internalizers' who were poor 'senders', but good at recognition of emotion. Levels of Extraversion and Neuroticism have not been measured in children and related to accuracy of recognition of emotion, though as noted above, Buck (1975) in his study of 'sending' ability measured Extraversion by reports of extravert characteristics from the subjects' teachers. In the present study it is predicted that there will be a positive correlation between Extraversion and accuracy of recognition of emotion scores. It might also be plausibly speculated that there will be a negative correlation between accuracy of recognition and Neuroticism scores

(i.e. high levels of anxiety interfering with judgment - especially in recognition of emotion in parts of the face).

5. Recognition of emotion in parts of the face: As noted in Chapter II, the results of studies of the adult's ability to recognize emotion from separate parts of the face conflict. The part of the face from which children find it easiest to recognize the six basic emotions will therefore be identified and compared with adult studies. The types of error children make in identifying emotions in each part of the face will also be identified, and compared to errors made in recognition of emotion in the whole face. (For reasons already noted this part of the study was confined to the female face.) It is hoped that from examination of the errors made in judging emotions from parts of the face a greater understanding will be gained about how children analyse faces to make judgments about the emotion portrayed. It is hypothesized that the facial area from which children find it easiest to recognize emotion will vary from emotion to emotion, and that the errors they make will reflect those found in recognition of emotion in the whole face.

THE SAMPLE

Two primary schools (one middle class and one working class), neither of which took part in the Pilot Studies, were used. All school classes from P1 to P7 were used in each school. The middle class school was situated in a pleasant suburban area, and had a nursery section which was included in the study. The working class school was in an inner city redevelopment area, and had no nursery section, so a nearby nursery school was used. The numbers and age range of the subjects were as follows:

The Sample

Age Range				No. of Middle Class Children	No. of Working Class Children
Yrs.	Mths.	Yrs.	Mths.		
3	6	3	11	13	11
4	0	4	11	26	21
5	0	5	11	28	30
6	0	6	11	35	32
7	0	7	11	33	33
8	0	8	11	39	39
9	0	9	11	32	13
10	0	10	11	35	25
11	0	11	7	21	23
				262	227

TOTAL = 489

The mean age was then calculated for middle class and working class children of both sexes.

Mean Ages

Mean ages (in months) of middle class and working class children

	Middle Class		Working Class		Whole Population	
	Mean Age	N	Mean Age	N	Mean Age	N
Girls	95.5	131	94.8	103	95.2	234
Boys	90.6	131	88.4	124	89.5	255
Total	93.0	262	91.1	227	92.2	489

Mean ages (in months) of sub-sample of children who did both matching and recognition

	Middle Class		Working Class		Total	
	Mean Age	N	Mean Age	N	Mean Age	N
Girls	52.4	22	63.6	38	59.5	60
Boys	53.8	26	64.8	47	60.9	73
Total	53.2	48	64.3	85	60.3	133

There was thus a slight sex imbalance. The age differences arose from the unequal number of children in the various classes in the middle class and working class schools.

During individual testing of the younger sub-sample the order of presentation of the male and female sets of photographs was systematically varied. However, by chance, those who identified emotion in the male face first were substantially older than those whose first task was identification of emotion in the female face. Due to the small number of children involved it was not possible to correct for age statistically, and 'order' was therefore dropped from detailed analysis. The evidence of the Pilot Studies suggested that order would not have a significant effect.

PROCEDURES

Nursery Children (Average Age 3.4 years)

The experimenter was introduced to the class by the teacher, and the children were told that the experimenter had brought some pictures for them to look at. Each child was taken individually to a quiet room. Testing proceeded as follows:

(1) Emotion Recognition was tested as in Pilot Study II with the amended Fear story. As in Pilot Study II the order of presentation of male and female sets of photographs was systematically varied.

(2) Emotion Matching was tested as in Pilot Study II. The standard instructions given were: "Here are some photographs which are the same as the ones you have just been looking at. Put each one on top of the one that it is the same as."

(3) Identification of emotion from the mouth alone: It would have been unreasonable to test nursery school children on recognition of emotion in all three parts of the face. It was thus decided to concentrate on the mouth, since this was the part of the face from which emotion was most accurately recognized in Pilot Study IV.

After completion of the matching test, the photographs of the whole face were covered up and a set of the six mouths were presented with the following instruction: "Remember we looked at the lady's face - well here are some mouths - let's see if you can pick the mouth of the lady who was happy because she was at a lovely party." Testing continued through the other emotions with a brief reminder of the story being given along with the emotion word.

(4) Details of Siblings: These were obtained by asking a standard sequence of questions (see Appendix 6).

(5) Date of Birth: This was obtained from the class register.

P1 & P2 Children (Average Age 4.9 years)

The experimenter was introduced to the class by the teacher, and the children were told that the experimenter had brought some pictures for them to look at. Each child was taken individually to a quiet room. Testing proceeded as follows.

(1) Emotion Recognition was tested using the same procedure as with the Nursery children, though female faces were always presented first, so that male faces would intervene between matching the female faces and identifying emotion in parts of the female face.

(2) Emotion Matching was tested using the same procedure as with the Nursery children.

(3) Recognition of Emotion in Parts of the Face: Each child was then tested on ability to recognize emotion in mouths, eyes and noses. Recognition of emotion in the mouths was tested using the same procedure as with the Nursery children. Testing of recognition of emotion in the eyes and noses followed the same procedure, with standard instructions being given (see Appendix 6).

(4) Details of Siblings: The procedure used with Nursery School children was followed.

(5) Sociometric Choices: To obtain an indication of popularity within each class, each child was asked: "If you were going to have a party and could invite two people from your class which two would you pick?".

(6) Date of Birth: Details of dates of birth were obtained from the class register.

P3 to P7 Children (Average Age 8.3 years)

Children were tested in a group in their own classroom. The procedure and materials were those used in Pilot Study IV with two amendments:

(i) In the instructions given prior to recognition of female emotion being tested "You can pick each photograph more than once if you want to," was added.

(ii) The set of response sheets had the Junior Eysenck Personality Inventory and a sheet to collect biographical data and sociometric choices added (see Appendix 7).

Testing proceeded as follows.

(1) Recognition of emotion in the whole female face, the whole male face, and in parts of the female face were tested.

(2) Personality Test: The Junior Eysenck Personality Inventory was then administered. Standard instructions were followed (see Appendix 6).

(3) Biographical data/Sociometric Choices: Standard instructions were followed (see Appendix 6).

Throughout testing, and filling in of biographical data and sociometric choices, a careful watch was kept to ensure that all children knew what they should be doing. Where necessary individual help was given, and the children were encouraged to ask for the

experimenter's help rather than consult a neighbour.

Social Class of subject was defined according to school attended and not individually.

Problems encountered during testing

Two nursery school working class children refused to co-operate with the experimenter. According to their teacher these children were generally unco-operative. However, two other children whom she had not expected to co-operate did successfully complete the procedure.

Only one older child refused to co-operate with the testing procedure. This P1 child burst into tears when taken to the testing room, refused to co-operate and insisted at length that the experimenter was not to look at his teeth. Despite reassurances that the experimenter was not interested in his teeth, the protests and tears continued and testing was abandoned. The teacher confirmed that the child had an extreme fear of the school dentist, who had been the last person to take the child from his class.

In the working class school the teacher of P11 re-entered the classroom shortly after testing began and tried to "chivvy" the children along in making their choices. Despite this, the experimenter kept the testing going at the already established pace, and reminded the children to choose carefully.

RESULTS

The purpose of the present study was to investigate the development of children's ability to recognize facially portrayed emotion. The five main areas to be investigated, outlined above, were examined by testing the following hypotheses.

Emotion Recognition

1. The ability to recognize emotion in the whole face and in parts of the face increases with age.

2. Emotion recognition ability develops in an identifiable sequence, with Happiness the first emotion reliably recognized. From Pilot Study results it is predicted the sequence will be: Happiness, Disgust, Sadness, Anger, Surprise, Fear.

3. The errors children make in emotion recognition are not random, and a pattern of 'common confusions' can be identified. As age increases it is predicted the number of errors made will fall - but the errors which are made are likely to be of the 'common confusion' type.

Emotion Matching

4. The ability to match faces on the basis of emotion portrayed increases with age.

5. It is predicted that Happiness will be the first emotion reliably matched. Since it is suspected that emotion recognition and emotion matching may occur by different processes, it is predicted that the order of difficulty of matching the remaining emotions will differ from that found for emotion recognition.

6. The errors made by children in matching faces on the basis of emotion portrayed are not random and a pattern of 'common confusions' will become more pronounced with age.

Relationship between Recognition and Matching of Emotions

7. Children can match faces on the basis of emotion expression before they can correctly select emotion in response to being read a short story.

Factors affecting Recognition Ability

8. Middle class children will recognize emotion more accurately than working class children of the same age.

9. First born children will recognize emotion more accurately than later born children of the same age.

10. 'Only' children will recognize emotion more accurately than children of the same age from families containing more than one child.

11. The most popular children will be the most accurate judges of emotion.

12. Girls will recognize emotion more accurately than boys.

13. There is a relationship between personality and ability to recognize emotion. More specifically it is hypothesized that Extraversion will be positively related to accuracy of recognition of emotion and Neuroticism will be negatively related.

Recognition of Emotion in Parts of the Face

14. The part of the face from which children find it easiest to recognize emotion will vary from emotion to emotion.

15. The types of error made in recognition of emotion in part of the face will reflect the types of error made in recognition of emotion in the whole face.

Statistical Analysis

The data were coded for computer analysis and a copy of the coding frame is appended (Appendix 8). The data were analysed using the Statistical Package for the Social Sciences (Versions 5 and 6).

The data collected were complex. As will be explained in the following results, the analyses had to be selective and concentrate on those which would result in the most knowledge being gained about the individual hypotheses under investigation. The nature of the data collected resulted, in a few instances, in data having to be presented in terms of percentages to allow valid comparison of accuracy over age, but analysed by frequency of correct recognition of individual emotions at specific ages.

HYPOTHESIS I: The ability to recognize emotion in the whole face and in parts of the face increases with age

Recognition of emotion in the whole face

The means and standard deviations of the number of correct identifications of male and female portrayals of all 6 emotions were calculated for each age group. The lowest score obtainable was thus zero and the highest six. In all the following tables 'Age 4' refers to children 4 years 0 months to 4 years 11 months old, and so on.

Table IV.1: Age and Recognition of Emotion in the Whole Face

		Female Portrayals of Emotion		Male Portrayals of Emotion	
Age	N	Mean	Standard Deviation	Mean	Standard Deviation
3	24	1.583	1.501	1.958	1.367
4	47	2.617	1.929	1.936	1.223
5	58	3.534	1.921	2.259	1.371
6	67	4.418	1.578	3.642	1.639
7	66	4.758	1.436	4.364	1.443
8	78	5.154	1.218	4.808	1.330
9	45	5.556	1.035	5.156	1.147
10	60	5.417	0.962	5.317	1.066
11	44	5.386	0.970	5.045	1.555
	489	4.478	1.803	3.886	1.840

Analysis of Variance

	Sum of Squares	Degrees of Freedom	Mean Square
Age by recognition of emotion in the Female Face			
Between Groups	597.954	8	74.744
Within Groups	988.071	480	2.058
Total	1586.025	488	
F = 36.310	p < 0.001		
Age by recognition of emotion in the Male Face			
Between Groups	574.679	8	71.835
Within Groups	1016.747	480	2.131
Total	1591.426	488	
F = 50.626	p < 0.001		

From Table IV.1 it can be seen that a very regular progression exists, with older children recognizing at every age (up to ages 9 to 11) more emotions than younger children. This progression is illustrated graphically in Fig. IV.1. The analysis of variance (Table IV.1) indicates that differences among the groups exist at a highly significant level for the male face ($F = 50.626$, $df = 488$, $p < 0.001$), and for the female face ($F = 36.310$, $df = 488$, $p < 0.001$). Consequently the hypothesis that there is an age development trend in accuracy of recognition of emotion is accepted with the qualification that, for these six emotions, the improvement levels off around ages nine to eleven.

Fig. IV.1: Age and recognition of emotion in the whole face

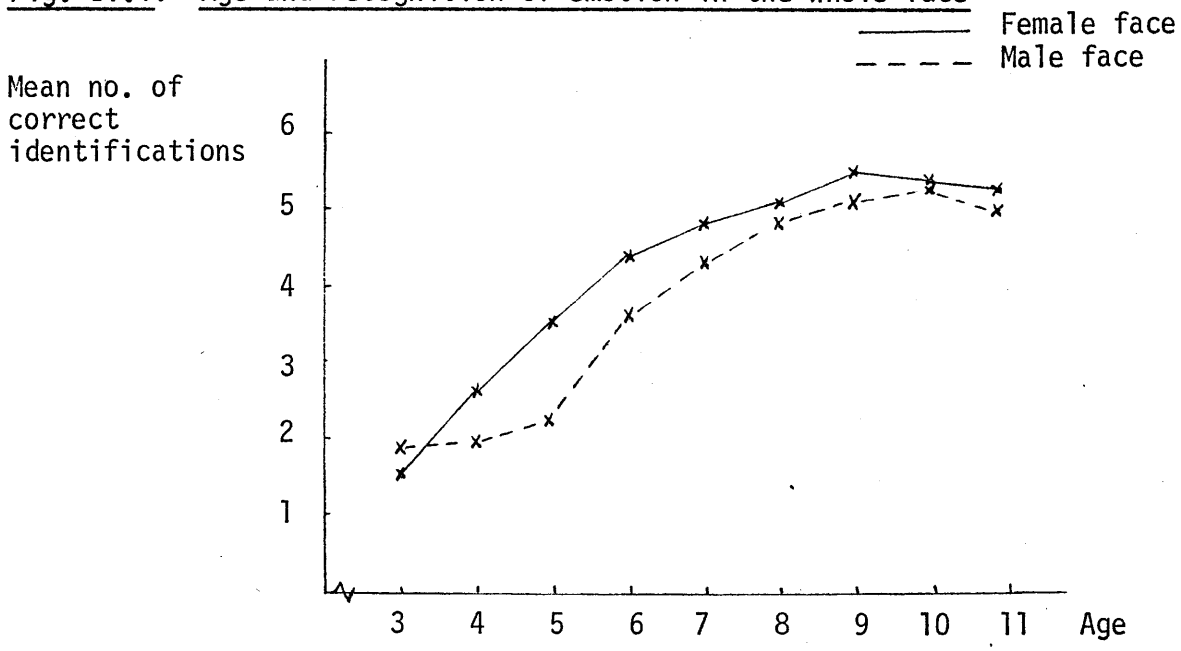


Table IV.2: Comparison of Accuracy of recognition of Male and Female Portrayals of Emotion

Age	Female Mean	Male Mean	t-value	Degrees of Freedom	One-tailed level of significance
3	1.583	1.958	-1.01	23	n.s.
4	2.617	1.936	2.26	46	0.029
5	3.534	2.259	5.25	57	0.0005
6	4.418	3.642	3.89	66	0.0005
7	4.758	4.364	1.59	65	n.s.
8	5.154	4.808	1.96	77	0.054
9	5.556	5.156	2.40	44	0.01
10	5.417	5.317	0.55	59	n.s.
11	5.386	5.046	1.40	43	n.s.

It is generally concluded that the female portrayals of emotion were more easily recognized than the male portrayals. Table IV.2 reveals the differences in recognition of male and female portrayals of emotion were significant except at ages 3, 7, 10 and 11. If the result for age 7 was omitted there would be a regular drop in the level of significance of the difference between ages 4 and 9. The non-significant difference at age 7 may have been due to the change to group testing at about age 7 and this will be discussed below.

Recognition levels of individual emotions

To identify if any of the differences in recognition of individual emotions in the male and female face were significant, χ^2 was calculated on the frequency of correct identifications of each emotion. (Table IV.3). Thus although there is evidence of an overall superiority in recognition of the female face, when this is further examined for each age and emotion no consistent pattern emerges. The difference between recognition of male and female portrayals of emotion is only significant at age 4 for Surprise, and at age 5 for Disgust, Sadness and Surprise.

Recognition of emotion in parts of the face

As noted in the methodology section, the youngest children were tested on emotion recognition in the whole male and female faces, and then given the matching test and identification of emotion in only the mouth rather than in all three parts of the face. (Where relevant the means obtained for this younger group will be appended to Tables.) To allow valid comparison of percentages of correct identification of emotion in all three parts of the face, the responses of those children who were tested on all three parts were selected and the means and standard deviations of the number of correct identifications of emotion at each age were calculated, and further examined by analysis of variance (Table IV.4).

Table IV.3: Frequency of Recognition of Male and Female portrayals of each emotion

Age	Female Face	Male Face	X^2	Female Face	Male Face	X^2
	Happiness			Disgust		
3	10 (42%)	15 (62%)	1.00	6 (25%)	2 (8%)	1.13
4	27 (57%)	33 (70%)	0.60	22 (47%)	18 (38%)	0.40
5	44 (76%)	49 (85%)	0.13	36 (62%)	21 (36%)	3.95*
6	63 (94%)	62 (92%)	0.01	52 (77%)	46 (69%)	0.37
7	63 (95%)	65 (98%)	0.03	42 (63%)	48 (73%)	0.40
8	76 (97%)	78(100%)	0.03	65 (84%)	65 (83%)	-
9	45(100%)	45(100%)	-	40 (88%)	38 (84%)	0.22
10	59 (98%)	60(100%)	0.01	51 (85%)	56 (93%)	0.23
11	44(100%)	43 (98%)	0.01	35 (79%)	35 (79%)	-
	Sadness			Anger		
3	10 (42%)	9 (37%)	-	3 (12%)	5 (21%)	-
4	27 (59%)	16 (34%)	2.81	16 (34%)	13 (28%)	0.30
5	43 (75%)	21 (36%)	7.56***	28 (48%)	17 (29%)	2.69
6	57 (85%)	47 (70%)	3.85	50 (75%)	35 (52%)	0.95
7	63 (95%)	45 (68%)	3.00	51 (77%)	38 (58%)	1.90
8	73 (93%)	71 (91%)	0.03	62 (80%)	56 (72%)	0.31
9	44(100%)	41 (91%)	0.11	40 (89%)	35 (78%)	0.17
10	59 (98%)	57 (95%)	0.03	52 (87%)	51 (85%)	0.01
11	44(100%)	39 (88%)	0.15	36 (82%)	35 (79%)	0.01
	Surprise			Fear		
3	5 (21%)	6 (25%)	-	6 (25%)	6 (25%)	-
4	19 (40%)	7 (15%)	5.54**	15 (32%)	7 (15%)	1.45
5	29 (50%)	14 (24%)	5.23*	24 (43%)	14 (24%)	1.32
6	36 (55%)	29 (44%)	0.75	37 (55%)	27 (40%)	0.78
7	50 (76%)	49 (74%)	0.01	44 (67%)	39 (59%)	0.15
8	67 (86%)	54 (69%)	1.40	61 (78%)	49 (64%)	0.65
9	40 (89%)	40 (88%)	-	41 (91%)	33 (75%)	0.43
10	52 (87%)	49 (81%)	0.09	52 (87%)	46 (76%)	0.18
11	39 (89%)	38 (86%)	0.01	39 (87%)	32 (73%)	0.35

*** $p < 0.01$
** $p < 0.02$
* $p < 0.05$

N = 489

(In all X^2 tables where the expected frequency was 10 or less Yates correction for contiguity was applied.)

Table IV:4: Age and recognition of emotion in parts of the face

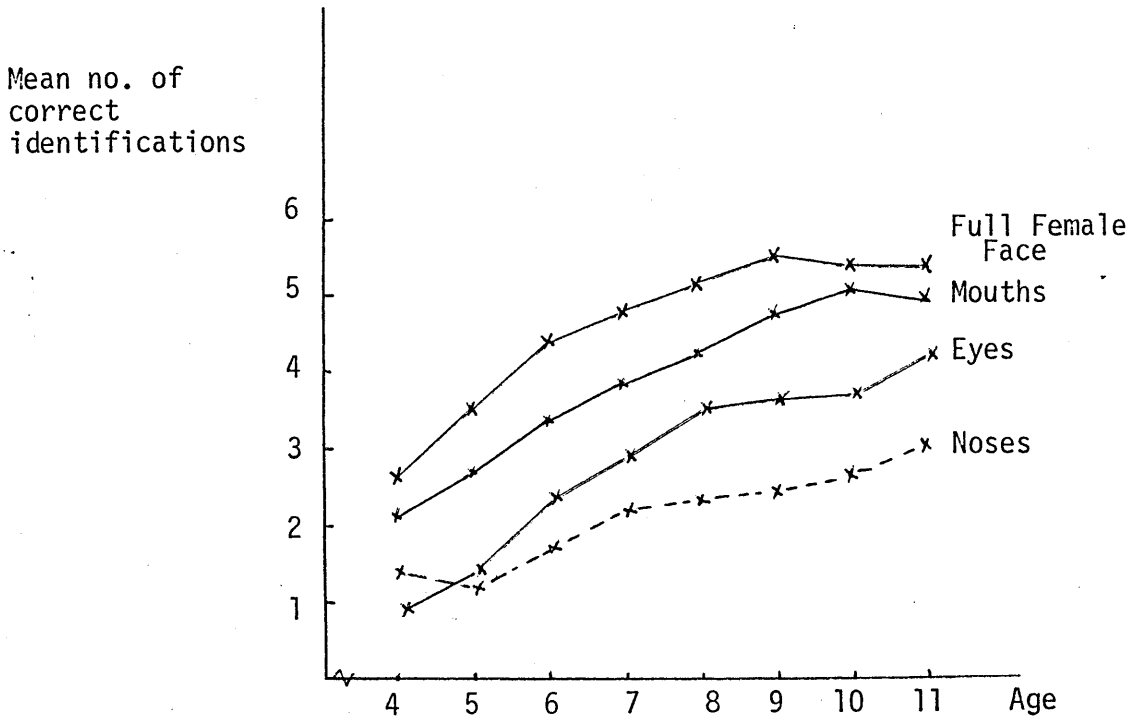
		Mouths		Eyes		Noses	
Age	N	Mean	S.D.	Mean	S.D.	Mean	S.D.
4	27	2.148	1.231	0.963	1.091	1.407	1.248
5	58	2.707	1.590	1.414	1.243	1.241	1.204
6	67	3.418	1.625	2.403	1.634	1.701	1.255
7	66	3.985	1.574	2.985	1.981	2.288	1.379
8	77	4.390	1.549	3.584	1.750	2.377	1.170
9	45	4.800	1.575	3.667	1.907	2.400	1.268
10	60	5.133	1.228	3.783	1.851	2.683	1.214
11	44	5.091	1.158	4.227	1.891	3.000	1.181
	444	4.038	1.738	2.973	1.976	2.160	1.349

Analysis of Variance

	Sum of Squares	Degrees of Freedom	Mean Square
Age by recognition of emotion in Mouths			
Between Groups	881.560	7	54.508
Within Groups	956.789	436	2.194
Total	1838.349		
F = 24.839	p < 0.001		
Age by recognition of emotion in Eyes			
Between Groups	430.928	7	61.561
Within Groups	1298.748	436	2.979
Total	1729.676		
F = 20.666	p < 0.001		
Age by recognition of emotion in Noses			
Between Groups	133.086	7	19.012
Within Groups	672.561	436	1.543
Total	805.647		
F = 12.325	p < 0.001		

From the analysis of variance it is clear that accuracy varies significantly with age. From Figure IV.2 it can be seen that the relationship between age and accuracy is positive, with the increase in accuracy beginning to level off around age 9. Over the whole age range tested the mouth was the part of the face from which emotions were most accurately identified.

Fig. IV.2: Age and recognition of emotion in parts of the face



(For the 3 year olds asked to recognize emotion in only the mouths the mean was 1.826 (S.D. 1.193), and for the whole population of 4 year olds the mean was 1.195 (S.D. 1.242).)

T-tests were used to establish whether, as expected, the differences in accuracy of recognition of emotion in parts of the face were significant. The values of t obtained are presented in Table IV.5, and were highly significant except in two instances - the difference in recognition of emotion in the eyes and noses at ages 4 and 5. The non-significant differences reflect the difficulty very young children experienced in recognition of emotion in both eyes and noses.

Recognition levels of individual emotions in parts of the face

In order to investigate whether differences in recognition of each emotion in each part of the face were significant, X^2 was applied to the frequency of correct responses for each part of the face at each age. Significant differences were identified in each emotion (Table IV.6).

Table IV:5: Comparisons of levels of recognition of emotions in parts of the face

Age	N	Variables	Means	Standard Deviation	Standard Error	t value	Degrees of Freedom	One-tailed level of significance
4	27	Mouths Eyes	2.148 0.963	1.841	0.354	3.35	26	0.001
		Mouths Noses	2.148 1.407	1.873	0.360	2.06	26	0.025
		Eyes Noses	0.963 1.407	1.625	0.313	-1.42	26	n.s.
5	58	Mouths Eyes	2.707 1.414	2.103	0.276	4.68	57	0.0005
		Mouths Noses	2.707 1.241	1.903	0.250	5.86	57	0.0005
		Eyes Noses	1.414 1.241	1.827	0.240	0.72	57	n.s.
6	67	Mouths Eyes	3.418 2.403	1.919	0.234	4.33	66	0.0005
		Mouths Noses	3.418 1.701	1.739	0.212	8.08	66	0.0005
		Eyes Noses	2.403 1.701	1.723	0.211	3.33	66	0.0005
7	66	Mouths Eyes	3.985 2.985	2.334	0.287	3.48	65	0.0005
		Mouths Noses	3.985 2.288	1.864	0.229	7.39	65	0.0005
		Eyes Noses	2.985 2.299	1.864	0.229	3.04	65	0.0015

Age	N	Variables	Means	Standard Deviation	Standard Error	t value	Degrees of Freedom	One-tailed level of significance
8	77	Mouths Eyes	4.390 3.584	2.177	0.248	3.25	76	0.001
		Mouths Noses	4.390 2.377	2.016	0.230	8.76	76	0.0005
		Eyes Noses	3.584 2.377	2.009	0.229	5.28	76	0.0005
9	45	Mouths Eyes	4.800 3.667	2.040	0.304	3.73	44	0.0005
		Mouths Noses	4.800 2.400	1.763	0.263	9.13	44	0.0005
		Eyes Noses	3.667 2.400	2.038	0.304	4.17	44	0.0005
10	60	Mouths Eyes	5.133 3.783	1.990	0.257	5.25	59	0.0005
		Mouths Noses	5.133 2.683	1.630	0.210	11.64	59	0.0005
		Eyes Noses	3.783 2.683	2.348	0.303	3.63	59	0.0005
11	44	Mouths Eyes	5.091 4.227	1.948	0.294	2.94	43	0.0025
		Mouths Noses	5.091 3.000	1.776	0.268	7.81	43	0.0005
		Eyes Noses	4.227 3.000	2.187	0.330	3.72	43	0.0005

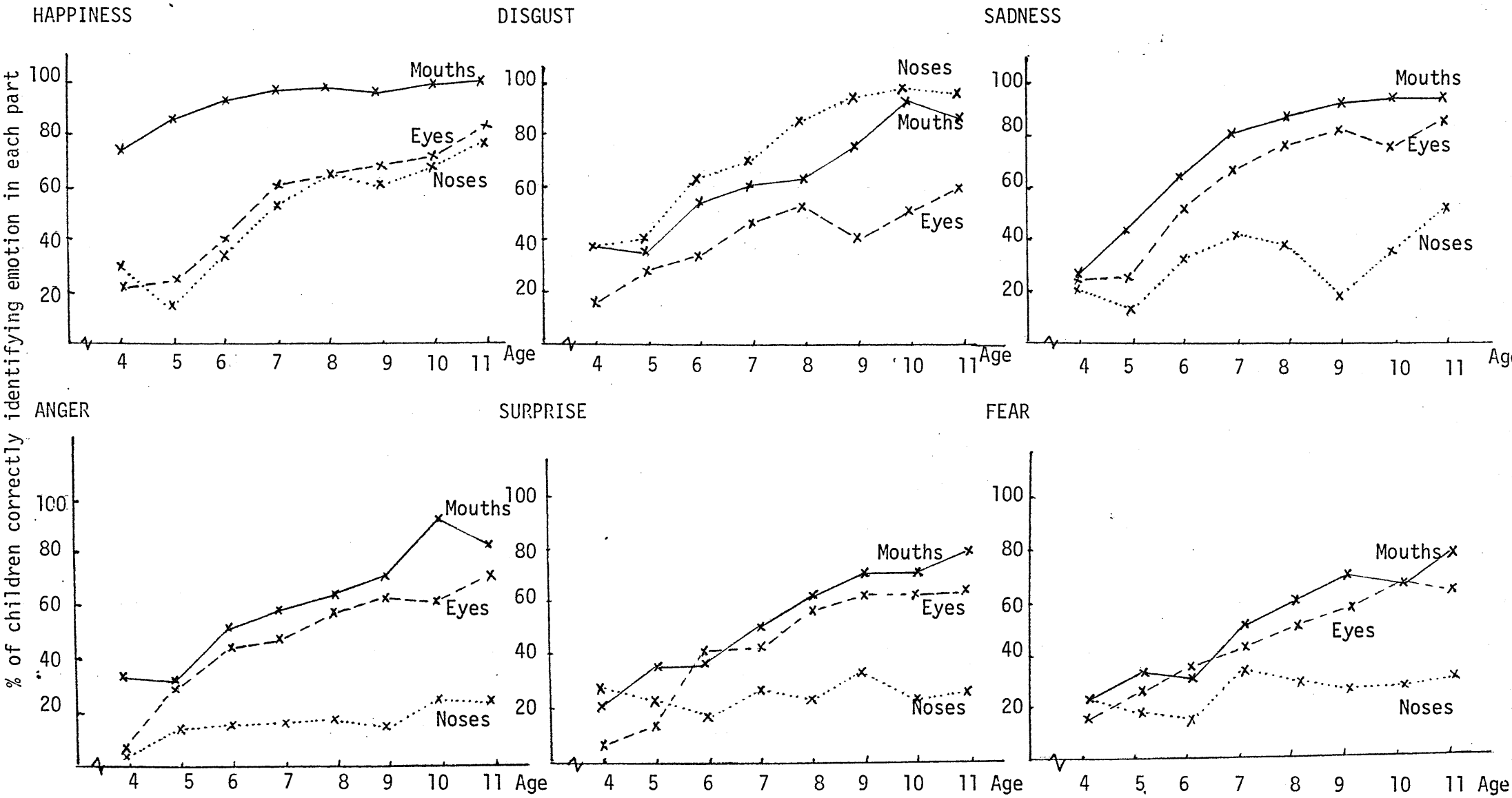
Table IV:6: Comparison of recognition of emotions in different parts of the face

Age	N	Mouths	Eyes	Noses	X^2	Mouths	Eyes	Noses	X^2
		Happiness				Disgust			
4	27	21	6	8	11.4*	10	4	10	-
5	58	51	14	9	42.68**	20	15	22	1.36
6	67	63	27	22	26.92**	37	22	41	6.02
7	66	64	40	34	10.87*	39	29	46	4.89
8	77	76	48	48	9.10	49	38	65	6.67
9	45	44	31	27	8.17	34	17	41	9.92*
10	60	60	42	40	5.11	54	29	57	10.15*
11	44	44	36	34	1.48	37	26	41	3.33
		Sadness				Anger			
4	27	8	7	6	-	9	2	1	-
5	58	26	12	8	9.52*	17	17	8	3.85
6	67	44	34	21	8.06	35	30	9	15.43**
7	66	54	44	27	8.98	39	30	10	16.74**
8	77	68	61	23	23.15**	51	44	11	25.85**
9	45	42	36	9	21.31**	32	27	5	19.38**
10	60	57	45	21	16.39**	55	36	14	24.06**
11	44	42	38	23	8.09	37	31	10	2.32
		Surprise				Fear			
4	27	6	2	8	-	6	4	6	-
5	58	22	9	13	6.04	18	14	9	2.97
6	67	29	27	12	7.62	21	25	9	7.57
7	66	34	28	17	5.65	32	27	21	2.28
8	77	48	44	18	14.48**	45	38	21	8.79
9	45	32	28	14	7.24	31	25	11	9.44*
10	60	42	38	13	15.93*	38	38	15	11.65*
11	44	35	28	11	12.35*	33	27	13	8.66

* $p < 0.01$ ** $p < 0.001$

To clarify the trends in recognition of the individual emotions, the percentage of children at each age correctly recognizing each emotion are plotted in Fig. IV.3. Examination of the six graphs indicates that only for Disgust is the nose the part of the face from which it is easiest to recognize emotion. For all the others emotion was more accurately recognized in the mouths.

Fig. IV.3: Percentage of children correctly identifying each emotion in each part of the face



For Happiness the recognition curves for the eyes and nose are very similar, and, in contrast with the other emotions, the recognition curve for the mouth is far above them.

The irregular pattern of recognition of emotions in the nose for the emotions Sadness, Anger, Surprise and Fear is perhaps due to children of all ages being more inclined to guess which was the correct photograph, and thus break the link with age. The more accurate recognition of Sadness in the nose is perhaps due to the fact that creasing around the nose gives a clue that Sadness is being portrayed; for Anger, Surprise and Fear there is no such creasing. From Fig. IV.3 and Table IV.6 it can be seen that in Sadness, Anger, Surprise and Fear recognition levels of emotion in noses remained low throughout - producing significant diferences among older children as accuracy of recognition of emotion in other parts of the face increases with age. The part of the face from which children find it easiest to recognize emotion will be discussed in detail below.

It can be concluded, nevertheless, that the hypothesis that the ability to recognize emotion in the whole face and in parts of the face increases with age was generally confirmed.

HYPOTHESIS 2: Emotion recognition ability develops in an identifiable sequence with Happiness the first emotion reliably recognized. From Pilot Study results it is predicted the sequence will be: Happiness, Disgust, Sadness, Anger, Surprise, Fear.

The number of correct identifications of emotion in the male and female faces were calculated and are presented in Table IV.7. X^2 was used to establish if the distribution of correct responses differed significantly from that expected by chance.

Table IV.7: Number of correct identifications of each emotion

	Happiness	Disgust	Sadness	Anger	Surprise	Fear	X^2
Female Face	431	349	420	338	339	319	30.44*
Male Face	450	329	346	285	286	253	75.51*

(N = 489)

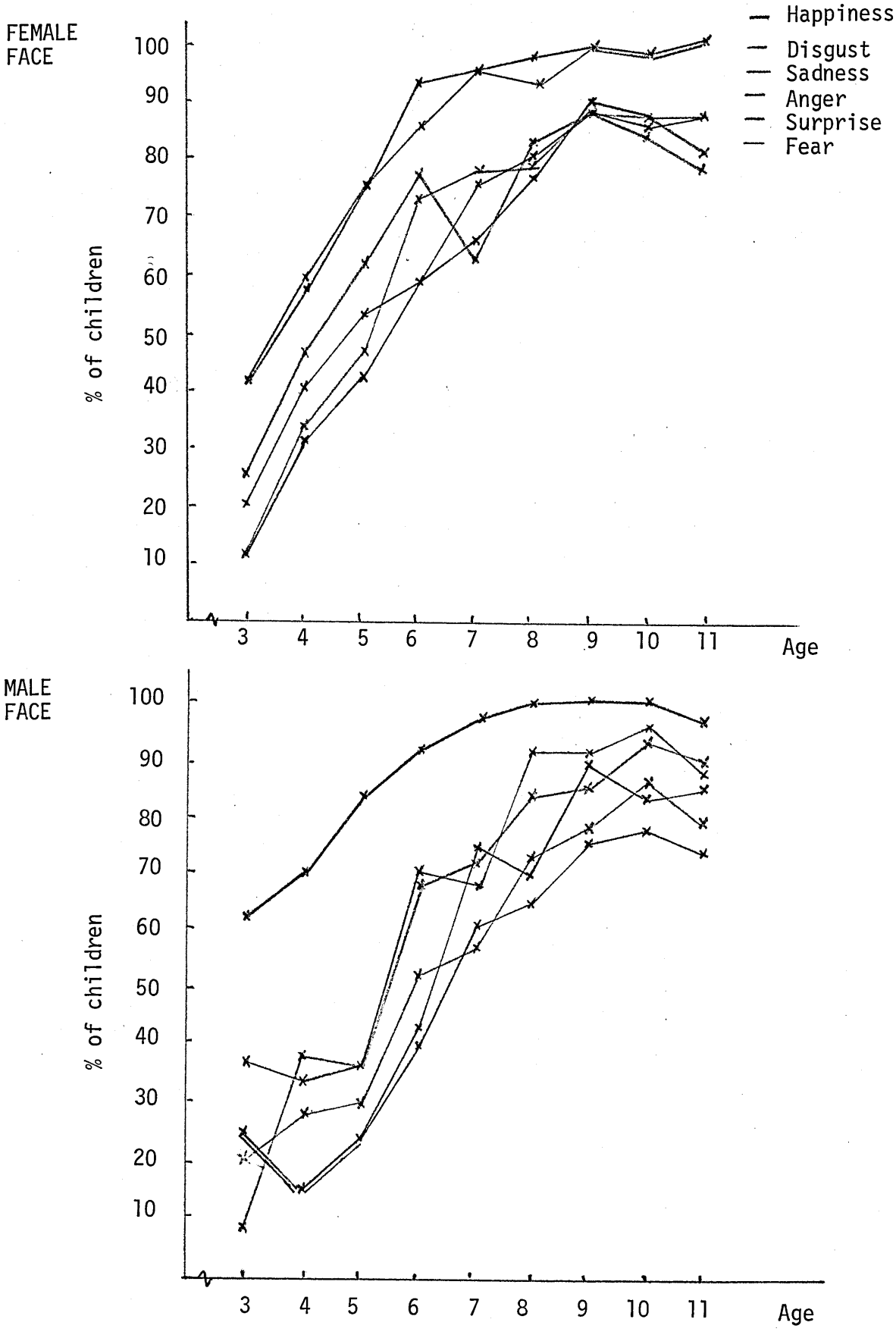
*p < 0.001

Thus the distribution of correct responses was significantly different from that expected by chance, indicating that children do find recognition of some emotions significantly more difficult than others. The 'order of difficulty' predicted from the Pilot Studies (i.e. Happiness, Disgust, Sadness, Anger, Surprise, Fear) was not fully verified. The order identified in the Main Study was identical for recognition of both male and female portrayals of emotion: Happiness, Sadness, Disgust, Anger/ Surprise, Fear.

To allow valid comparison of recognition levels of the individual emotions across all ages, the percentage of children at each age correctly identifying each emotion is presented in Fig. IV.4. The order of difficulty varies slightly from age to age, but overall the curves reflect the growth of accuracy of recognition of all the emotions with age. Fig. IV.4 shows that, in the female face, Sadness is the emotion most accurately recognized by 3 to 5 year olds - and the Happiness and Sadness curves remain very similar throughout, becoming identical between 9 and 11. In the male face, however, Happiness remains the most accurately recognized emotion at all ages, and it is only from 8 onwards that the levels of recognition of other emotions approach that for Happiness.

However, when such differences are examined statistically, it can be seen from Table IV.8 that only in recognition of emotions in the

Fig. IV.4: Percentage of children correctly identifying male and female emotions



male face at ages 4, 5 and 6 were the individual emotions recognized at significantly different levels.

Table IV:8: Frequency of Correct Recognition of Individual Emotions by age

Age	Happiness	Disgust	Sadness	Anger	Surprise	Fear	X^2
Female Face							
3	10	6	10	3	5	6	5.41
4	27	22	27	16	19	15	5.38
5	44	36	43	28	29	24	10.18
6	63	52	57	50	36	37	11.90
7	63	42	63	51	50	44	7.88
8	76	65	73	62	67	61	2.70
9	45	40	44	40	40	41	0.62
10	59	51	59	52	52	52	1.31
11	44	35	44	36	39	39	2.06
Male Face							
3	15	2	9	5	6	6	13.79
4	33	18	16	13	7	7	29.58*
5	49	21	21	17	14	14	38.88*
6	62	46	47	35	29	27	21.42*
7	65	48	45	38	49	39	10.09
8	78	65	71	56	54	49	9.43
9	45	38	41	35	40	33	2.42
10	60	56	57	51	49	46	2.70
11	43	35	39	35	38	32	2.01

* $p < 0.001$

The results obtained thus indicate that emotion recognition does develop in an identifiable sequence. Regular trends appear, suggesting that Happiness is the emotion most accurately recognized in the male face by young children, and that in the female face Happiness and Sadness are recognized with almost equal accuracy by 3 to 11 year olds. However, when broken down by age the differences between recognition

of the individual emotions did not reach statistical significance for the female face. Differences in accuracy of recognition of emotion in the male face were significant only at ages 4, 5 and 6. The order of difficulty overall differed slightly from that predicted from Pilot Study results.

HYPOTHESIS 3: The errors children made in emotion recognition are not random, and a pattern of 'common confusions' can be identified. As age increases it is predicted the number of errors made will fall - but the errors which are made are likely to be of the 'common confusion' type.

Errors in recognition of emotion in the whole face.

The number of times each emotion was chosen in error for each of the remaining emotions was calculated (see Table IV.9). If errors made by children when asked, for example, to select Happiness were random then the total of 58 errors should be spread evenly among the remaining five emotions i.e. 11 or 12 errors in each. Inspection of the results indicates that this did not occur. To investigate whether the distribution was significantly different from that expected by chance X^2 was used.

Table IV.9: Total errors made in recognition of emotion in whole face

	Emotion selected						
Emotion to be selected	Happiness	Disgust	Sadness	Anger	Surprise	Fear	X^2
Female Face							
Happiness	-	2	6	10	25	15	26.45*
Disgust	5	-	20	88	16	10	166.40*
Sadness	4	22	-	21	12	7	20.17*
Anger	8	68	20	-	13	41	81.03*
Surprise	24	9	8	25	-	84	135.13*
Fear	17	15	18	18	100	-	162.22*

Male Face

Emotion selected

Emotion to be selected	Happiness	Disgust	Sadness	Anger	Surprise	Fear	X^2
Happiness	-	3	7	7	8	14	6.60
Disgust	13	-	37	61	27	22	42.23*
Sadness	3	41	-	55	12	32	61.73*
Anger	9	64	34	-	34	63	52.08*
Surprise	34	14	22	32	-	100	40.50*
Fear	9	31	40	48	105	-	108.80*

* $p < 0.001$

As can be seen from Table IV.9 the errors made in recognition of emotion were not random. The most common confusions are presented in Table IV.10.

Table IV.10: Common Confusions in Emotion Recognition

Emotion to be selected	Emotion selected	
	Female Face	Male Face
Happiness	Surprise	Fear
Disgust	Anger	Anger
Sadness	Disgust/Anger	Anger
Anger	Disgust	Disgust/Fear
Surprise	Fear	Fear
Fear	Surprise	Surprise

Thus the most common confusions when children were asked to select Disgust, Surprise and Fear are identical whether the emotion is portrayed by the male or female face. However, when asked to select Happiness, Surprise was the emotion most often chosen in error in the female face, and Fear the most often chosen in error in the male face. For Sadness, Anger was the most common error in the male face with Disgust the second most common error. However, in the female, Anger and Disgust were chosen almost equally often in error for Sadness.

When asked to select Anger, Disgust was the most common error in the female face, with Fear second, while in the male face Disgust and Fear were selected almost equally. Thus while overall the pattern of errors in recognition of emotion in the male and female face were strikingly similar, there remained some interesting differences.

Age and errors made in emotion recognition in the whole face

The total number of errors in Table IV.9 was broken down into three age groups - 3 to 5 years (N = 127), 6 to 8 years (N = 211), and 9 to 11 years (N = 148) (Table IV.11).

Table IV.11: Total errors made in recognition of female emotion by age

		Emotion selected						
Emotion to be selected	Age	Happiness	Disgust	Sadness	Anger	Surprise	Fear	X^2
Happiness	3-5	-	1	6	10	19	12	16.86*
	6-8	-	1	0	0	5	3	-
	9-11	-	0	0	0	1	0	-
Disgust	3-5	2	-	12	34	12	5	48.31***
	6-8	3	-	8	33	3	4	65.36***
	9-11	0	-	0	21	-	1	-
Sadness	3-5	4	16	-	15	9	3	12.87*
	6-8	0	5	-	6	3	4	-
	9-11	0	1	-	0	0	0	-
Anger	3-5	7	29	14	-	9	23	16.57**
	6-8	1	21	5	-	4	16	31.61***
	9-11	0	18	1	-	0	2	-
Surprise	3-5	14	7	6	21	-	28	25.75***
	6-8	10	0	2	4	-	40	97.58***
	9-11	0	2	0	0	-	16	-
Fear	3-5	14	10	14	7	37	-	36.51***
	6-8	3	5	4	10	47	-	109.83***
	9-11	0	0	0	1	16	-	-

(- indicates cell size too small for calculation of X^2)

* < 0.02
** < 0.01
*** < 0.001

Despite the difference in number of children in each age group, inspection of Table IV.11 shows that the relative number of errors made decreases with age, and that they also become less random. The number of 'empty' cells or cells with only one or two errors increases with age indicating decreasing randomness.

The common confusions listed in Table IV.10 do become more pronounced with age - e.g. for Surprise 16 of the 18 errors made by 9 to 11 year olds are of choosing Fear; for Fear 16 of the 17 errors are of choosing Surprise. Among the 3 to 5 year olds only 28 of a total of 76 errors were of choosing Fear for Surprise, and out of a total of 82 errors made in recognition of Fear only 37 were of selecting Surprise.

Table IV.12: Total errors made in recognition of male emotion by age

Emotion to be selected	Age	Emotion selected: Happiness	Disgust	Sadness	Anger	Surprise	Fear	X^2
Happiness	3-5	-	3	7	7	5	10	2.76
	6-8	-	0	0	0	2	4	-
	9-11	-	0	0	0	1	0	-
Disgust	3-5	11	-	16	34	14	13	19.85**
	6-8	1	-	16	19	11	5	23.93**
	9-11	1	-	5	8	2	4	-
Sadness	3-5	2	27	-	24	10	20	25.98**
	6-8	1	10	-	25	2	10	38.46**
	9-11	0	4	-	6	0	2	-
Anger	3-5	5	25	18	-	26	20	15.04*
	6-8	4	26	13	-	8	31	33.00**
	9-11	0	13	3	-	0	12	24.79**
Surprise	3-5	24	11	18	18	-	31	6.56*
	6-8	10	3	4	11	-	50	98.04**
	9-11	0	0	0	3	-	19	-
Fear	3-5	5	20	21	17	38	-	27.67**
	6-8	4	9	12	23	47	-	61.78**
	9-11	0	2	7	8	20	-	29.46**

(- indicates cell size too small for calculation of X^2)

* $p < 0.01$
** $P < 0.001$

The relative number of errors made in recognition of emotion in the male face also decreased with age (Table IV.12). Inspection of Table IV.12 indicates that errors do become more systematic with age - the number of empty cells increases with age, but there are fewer than in Table IV.11. This is a result of children finding recognition of emotion in the male face more difficult than in the female face.

While the 'common confusions' identified in Table IV.8 do become more pronounced with age, this is less clear cut than in Table IV.11. Among the 9 to 11 year olds, 20 out of the 37 errors in recognition of Fear were of choosing Surprise; among 3 to 5 year olds it was 38 out of 101. In recognition of Surprise, 19 out of the 22 errors made by 9 to 11 year olds were of choosing Fear, among 3 to 5 year olds it was 31 out of 102.

The hypothesis that the errors children make in emotion recognition are not random and a pattern of 'common confusions' can be identified was thus confirmed. As age increased, the number of errors made fell and the errors made were more likely to be of the common confusion type.

HYPOTHESIS 4: The ability to match faces on the basis of emotion expression increases with age.

Age and Emotion Matching

Emotion matching consisted of matching each set of photographs (i.e. the six basic emotions portrayed by one male and one female) to an identical set placed on the table. The subjects' scores could range from 0 to 6 on each set. The means and standard deviations of the number of male and female faces correctly matched on the basis of emotion expression were calculated, and further analysed by analysis of variance. T-tests were used to identify any significant differences in matching of the male and female faces. In all there were 133 subjects, ranging from 3 to 6 years, who were tested on emotion matching.

Table IV.13: Age and matching of male and female portrayals of emotion

		MALE		FEMALE				
Age	N	Mean	S.D.	Mean	S.D.	t-value	df	sig.
3	24	3.000	1.865	2.958	1.628	0.10	23	n.s.
4	47	3.681	2.198	3.979	1.973	-1.01	46	n.s.
5	39	4.436	1.774	5.103	1.518	2.23	38	0.025
6	23	4.304	1.608	5.522	0.947	2.89	22	0.005

Analysis of Variance

	Sum of Squares	Degrees of Freedom	Mean Square
Female Face			
Between Groups	36.636	3	12.212
Within Groups	478.672	129	3.711
Total	515.308	132	
F = 3.291 (not significant)			
Male Face			
Between Groups	106.403	3	35.468
Within Groups	347.266	129	2.692
Total	453.669	132	
F = 13.175 ($p < 0.05$)			

Thus the increase with age in ability to match female portrayals of emotion was not significant, but the age-related increase in ability to match male portrayals of emotion was significant (at the 5% level). From Table IV.13 it can be seen that at 5 and 6, male faces were matched significantly more accurately than female faces.

The hypothesis that the ability to match faces on the basis of emotion expression increases with age was therefore confirmed for the male face, but rejected for the female face.

HYPOTHESIS 5: It is predicted that Happiness will be the first emotion reliably matched. Since it is suspected that emotion recognition and emotion matching may occur by different processes, it is predicted that the order of difficulty of matching the remaining emotions will differ from that found for emotion recognition.

The number of correct identifications and matchings of each emotion was calculated for the sub-sample of children who did both recognition and matching. X^2 was applied to the frequencies to identify significant differences.

Table IV.14: Accuracy of matching and recognition of individual emotions

	Female Faces			Male Faces		
	Correct Matchings	Correct Recognitions	X^2	Correct Matchings	Correct Recognitions	X^2
Happiness	104	83	2.15	104	99	0.12
Disgust	67	70	0.06	83	40	15.03**
Sadness	99	82	1.60	104	52	8.66*
Anger	86	49	10.14*	98	38	26.47**
Surprise	90	52	11.29**	116	27	55.39**
Fear	73	45	6.64	82	27	27.75**

(N = 133)

* $p < 0.01$

** $p < 0.001$

Thus although Happiness was the emotion most accurately matched in the female face, Surprise was the emotion most accurately matched in the male. As can be seen from Table IV.14 the order of difficulty varies between matching and recognition of emotion, and these are presented for comparison in Table IV.15.

Table IV.15: Order of Difficulty in Recognition and Matching

Female Face		Male Face	
Matching	Recognition	Matching	Recognition
Happiness	Happiness	Surprise	Happiness
Sadness	Sadness	Happiness	Sadness
Surprise	Disgust	Sadness	Disgust
Anger	Surprise	Anger	Anger
Fear	Anger	Fear	Surprise
Disgust	Fear	Disgust	Fear

The hypothesis that other than for Happiness the order of difficulty of the remaining emotions will differ from that found in emotion recognition was thus confirmed for the female face. For the male face the emotion most accurately matched was Surprise.

HYPOTHESIS 6: The errors made by children in matching faces on the basis of emotion portrayed are not random, and a pattern of common confusions will become more pronounced with age.

Errors in matching of emotion

The errors made by children in matching faces on the basis of emotion portrayed were analysed using the same method as for errors in emotion recognition.

Table IV.16: Total errors in emotion matching

	Emotion matched						
Emotion to be matched	Happiness	Disgust	Sadness	Anger	Surprise	Fear	X^2
Female Face							
Happiness	-	4	2	12	9	1	12.66*
Disgust	7	1	6	4	7	41	77.71***
Sadness	1	13	-	6	5	8	10.45*
Anger	11	8	3	-	19	6	13.62*
Surprise	11	6	7	16	-	3	9.63*
Fear	1	33	16	1	1	-	77.09***
Male Face							
Happiness	-	6	3	10	3	7	4.62
Disgust	9	-	9	8	1	23	25.60***
Sadness	3	8	-	7	2	9	4.80
Anger	12	5	3	-	8	7	5.00
Surprise	2	5	0	6	-	4	-
Fear	6	23	12	5	5	-	23.90***

* < 0.05
** < 0.01
*** < 0.001

Inspection of Table IV.16 indicates that the errors made in matching both male and female faces on the basis of emotion portrayed were not random. Errors made in matching female faces were more systematic than those made in matching male faces. The most common confusions are presented in Table IV.17.

Table IV.17: Common Confusions in Emotion Matching

Emotion to be matched	Emotion Matched most often in Error	
	Female Face	Male Face
Happiness	Anger	Anger
Disgust	Fear	Fear
Sadness	Disgust	Fear/Disgust
Anger	Surprise	Happiness
Surprise	Anger	Anger
Fear	Disgust	Disgust

Errors made in matching emotions and age

The total errors made in matching of emotion were broken down by age. There were 24 three year olds, 47 four year olds, 40 five year olds and 22 six year olds in the sub-sample who did matching.

Table IV.18: Female Face: Matching errors and age

Emotion to be matched	Age	Emotion matched: Happiness	Disgust	Sadness	Anger	Surprise	Fear
Happiness	3	-	4	0	3	4	0
	4	-	0	2	7	1	0
	5	-	0	0	1	3	1
	6	-	0	0	1	1	0
Disgust	3	3	-	1	2	5	4
	4	3	-	0	1	2	14
	5	1	-	3	1	0	13
	6	0	-	2	0	0	10
Sadness	3	1	2	-	2	0	4
	4	0	4	-	2	3	3
	5	0	4	-	1	2	0
	6	0	3	-	1	0	1

		Emotion matched					
Emotion to be matched	Age	Happiness	Disgust	Sadness	Anger	Surprise	Fear
Anger	3	2	3	0	-	5	2
	4	4	3	1	-	10	3
	5	3	2	1	-	1	1
	6	2	0	1	-	3	0
Surprise	3	5	2	3	2	-	1
	4	3	3	2	9	-	1
	5	1	1	2	2	-	1
	6	2	0	0	3	-	0
Fear	3	0	4	5	2	0	-
	4	0	10	8	2	1	-
	5	1	11	1	3	0	-
	6	0	9	2	0	0	-

It was not possible to calculate X^2 because of small cell size. It is only possible to note, by inspection of Table IV.18, that despite the difference in number of subjects at each age, the number of empty cells increases with age, indicating that errors both decrease with age and become less random. Despite the small number of errors made by older children, it can be seen that the common confusions listed in Table 17 are more pronounced among older children than among the younger children (especially the Disgust/Fear and Fear/Disgust confusion).

Table IV.19: Male face: matching errors and age

		Emotion matched					
Emotion to be matched	Age	Happiness	Disgust	Sadness	Anger	Surprise	Fear
Happiness	3	-	0	1	4	0	4
	4	-	4	3	3	3	2
	5	-	2	3	3	0	1
	6	-	0	0	0	0	0
Disgust	3	1	-	5	1	1	7
	4	5	-	3	3	0	11
	5	2	-	1	3	0	2
	6	1	-	0	1	0	3

Emotion to be matched	Age	Emotion matched: Happiness	Disgust	Sadness	Anger	Surprise	Fear
Sadness	3	2	3	-	6	1	1
	4	0	1	-	1	0	7
	5	1	3	-	0	1	1
	6	0	1	-	0	0	0
Anger	3	2	3	2	-	1	4
	4	6	1	1	-	5	3
	5	4	0	0	-	2	0
	6	0	1	0	-	0	0
Surprise	3	2	1	0	0	-	2
	4	0	3	0	6	-	1
	5	0	1	0	0	-	1
	6	0	0	0	0	-	0
Fear	3	3	7	4	2	3	-
	4	2	12	4	3	2	-
	5	1	1	4	0	0	-
	6	0	3	0	0	0	-

As with the female face, it was not possible to calculate X^2 due to small cell size. However, inspection of Table IV.19 indicates that (even allowing for difference in number of subjects at each age) the number of empty cells increases with age, indicating that as age increases fewer errors are made and that they become less random. The small number of errors made makes it difficult to trace the development of common confusions. However, the Disgust/Fear and Fear/Disgust confusions present in matching the female face are also present here.

The data thus confirm that the errors made by children in matching faces on the basis of emotion portrayed are not random and a pattern of common confusions becomes more pronounced with age.

HYPOTHESIS 7: Children can match faces on the basis of emotion expression before they can correctly select emotion in response to being read a short story.

Recognition scores were selected for those children who had undertaken the matching test. An individual's score could vary from

0 to 6 for each set of photographs. T-tests were applied to the means of recognition and matching scores for both male and female faces.

Table IV.20: Accuracy of matching compared to accuracy of recognition

	Female Faces Mean	Male Faces Mean
Recognition	2.83	2.09
	*	*
Matching	3.85	4.43

N = 133 *p < 0.0005

From Table IV.20 it can be seen that the difference in means was highly significant for both the female faces ($t = 5.49$, $df = 132$, $p < 0.0005$) and male faces ($t = 14.23$, $df = 132$, $p < 0.0005$). This hypothesis was therefore confirmed and the values of t obtained were well within the value required for a one-tailed test at the 0.0005 level of significance.

Matching and Recognition of individual emotions

To investigate whether the difference between recognition and matching of individual emotions was significant, X^2 was applied to the frequency of correct identifications and matchings at each age. (Table IV.21). No significant differences were found between recognition and matching of the female face, but for the male face significant differences were revealed in each emotion except Happiness.

As can be seen from Table IV.14, for the whole sub-sample the difference between recognition and matching of Anger, Surprise and Fear was significant in the female face, and in the male face the difference was significant for Sadness, Disgust, Anger, Surprise and Fear.

The hypothesis that children can match faces on the basis of emotion expression before they can correctly select emotion in

Table IV.21: Comparison of accuracy of recognition and matching of individual emotions by age

Emotion	Age	Female Face: No. of accurate Matchings No.	Female Face: Matchings (%)	Female Face: No. of accurate Recognitions No.	Female Face: Recognitions (%)	X^2	Male Face: No. of accurate Matchings No.	Male Face: Matchings (%)	Male Face: No. of accurate Recognitions No.	Male Face: Recognitions (%)	X^2
Happiness	3	13	(63)	10	(41)	0.40	15	(69)	15	(62)	-
	4	36	(66)	27	(57)	1.29	34	(56)	33	(70)	0.01
	5	34	(83)	27	(69)	0.02	33	(79)	32	(82)	1.00
	6	21	(93)	19	(87)	0.01	22	(97)	83	(83)	0.22
Disgust	3	9	(77)	6	(25)	0.27	7	(70)	2	(8)	3.27
	4	26	(75)	22	(49)	0.31	25	(56)	18	(38)	1.14
	5	21	(82)	25	(64)	0.35	31	(84)	10	(26)	10.76*
	6	11	(88)	17	(74)	1.29	18	(90)	10	(43)	2.29
Sadness	3	15	(74)	10	(42)	1.00	11	(55)	9	(37)	0.05
	4	34	(65)	27	(59)	0.80	38	(69)	16	(34)	8.96*
	5	32	(80)	29	(76)	0.07	33	(79)	13	(33)	8.70*
	6	18	(85)	16	(70)	0.12	22	(97)	14	(61)	1.78
Anger	3	12	(76)	3	(12)	4.27	12	(66)	5	(21)	2.12
	4	26	(58)	16	(34)	2.38	31	(54)	13	(28)	7.36*
	5	31	(84)	19	(49)	2.88	33	(83)	12	(31)	9.80*
	6	17	(88)	11	(48)	1.29	22	(97)	8	(35)	6.53*
Surprise	3	11	(71)	5	(21)	1.56	19	(70)	6	(25)	6.76*
	4	29	(60)	19	(40)	2.08	37	(41)	7	(15)	20.45**
	5	32	(84)	17	(44)	4.59	37	(88)	8	(20)	18.69**
	6	18	(89)	11	(48)	1.69	23	(100)	6	(26)	9.97*
Fear	3	13	(82)	6	(25)	1.89	5	(63)	6	(25)	0.09
	4	25	(66)	15	(31)	2.50	24	(55)	7	(15)	9.32*
	5	23	(74)	13	(35)	2.78	33	(88)	7	(18)	16.90**
	6	12	(82)	11	(48)	0.04	20	(97)	7	(30)	6.26

N = 133

* $p < 0.01$
** $p < 0.001$

response to being read a short story was therefore confirmed in relation to total recognition and matching scores. Analysis of recognition and matching of individual emotions revealed significant differences between recognition and matching in the male and female face for Anger, Surprise and Fear, and also for Disgust portrayed by the male. When broken down by age the differences did not reach significance in the female face, but significant differences were identified for the male face.

HYPOTHESIS 8: Middle class children will recognize emotion more accurately than working class children of the same age.

Social Class and recognition of emotion in the whole face

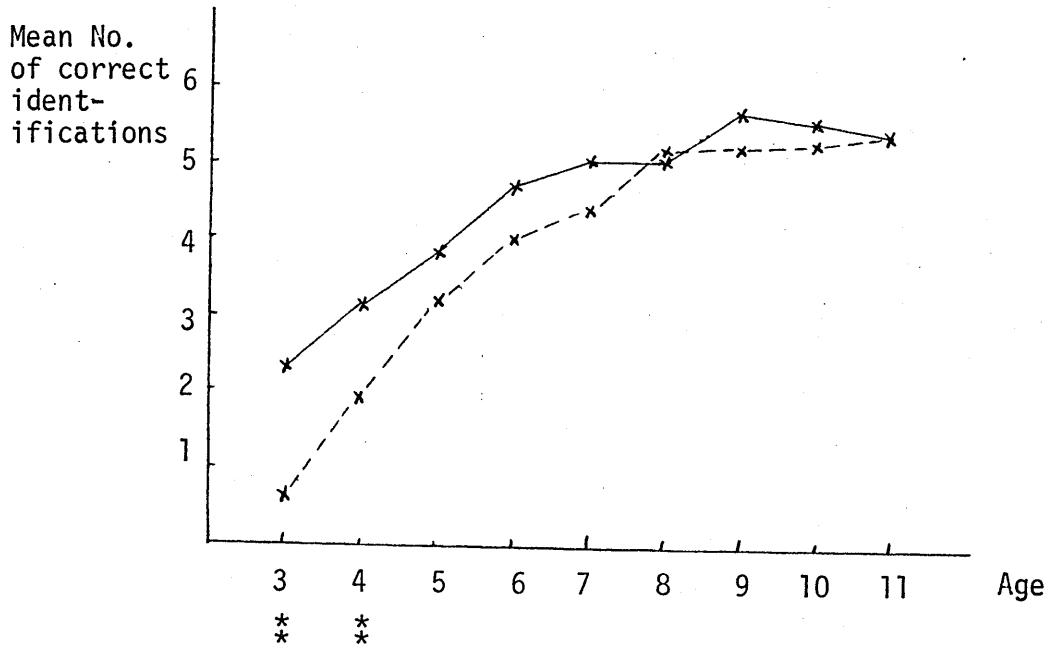
The means of the number of correct identifications of male and female portrayals of emotion made by children of each age at the middle class and working class schools were calculated, and are presented in graph form in Fig. IV.5. From this it is apparent that middle class children recognized female portrayals of emotion more accurately than working class children between the ages of 3 and 7. Between 8 and 11 the curves for middle class and working class children become virtually identical. However, although middle class children recognize male portrayals of emotion more accurately than working class children between the ages of 3 and 6, both classes perform at similar levels of accuracy between the ages of 7 and 9, and the class difference in recognition levels becomes apparent again at ages 10 and 11.

Age was then recoded to three groups (3 to 5, 6 to 8 and 9 to 11 year olds) and a two-way analysis of variance (age by social class) applied (Table IV.22).

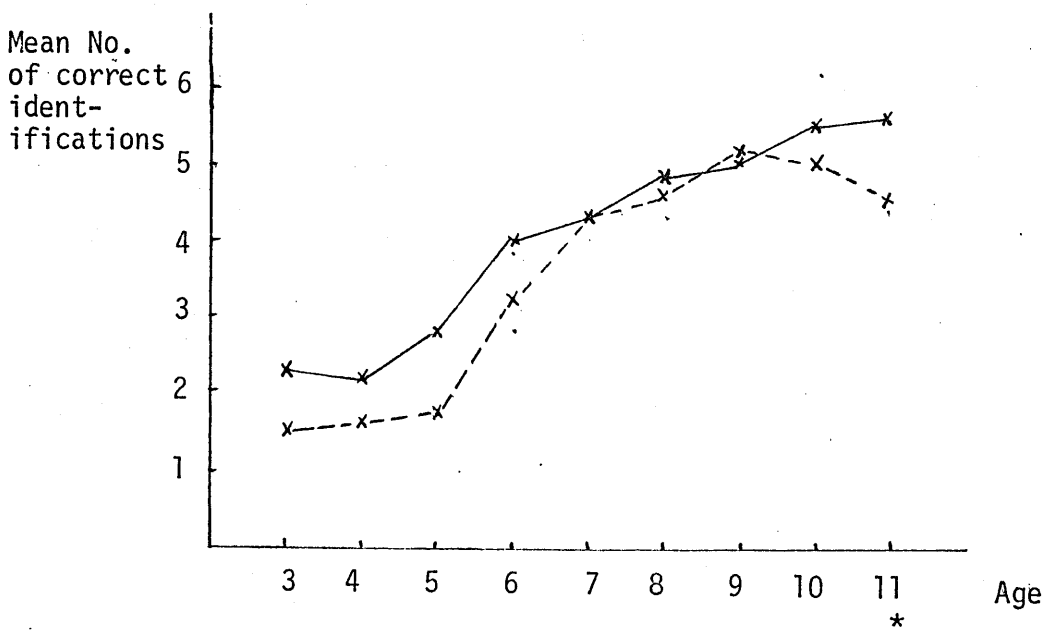
Fig. IV.5: Middle Class and Working Class children: Recognition of Emotion in the Whole Face

——— Middle Class
– – – – – – Working Class

Female Face



Male Face



** p = 0.05
* p = 0.01

Table IV.22: Analysis of variance: Accuracy of recognition of emotion in the whole face by age and social class

Source of Variation	Sum of Squares	df	Mean Square	F	Sig.
Female Face					
Main Effects	532.680	3	177.560	82.243	0.001
Age	500.433	2	250.216	115.896	0.001
Social Class	23.346	1	23.346	10.813	0.001
2-way Interactions	10.559	2	5.279	2.445	0.088
Age x Social Class	10.559	2	5.279	2.445	0.088
Explained	543.238	5	108.648	50.324	0.001
Residual	1042.786	483	2.159		
Total	1586.024	488	3.250		
Male Face					
Main Effects	732.471	3	244.157	128.922	0.001
Age	688.954	2	344.477	181.894	0.001
Social Class	30.561	1	30.561	16.137	0.001
2-way Interactions	5.708	2	2.854	1.507	0.223
Age x Social Class	5.708	2	2.854	1.507	0.223
Explained	738.179	5	147.636	77.956	0.001
Residual	914.721	483	1.894		
Total	1652.900	488	3.387		

From Table IV.22 it can be seen that recognition of emotion in the whole male and female face varies significantly with both age and social class. There were no significant two-way interactions between age and social class.

T-tests were then used on the means for each age (Table IV.23). The difference in mean number of emotions correctly identified was significant for the female face at age 3 and 4, and for the male face at age 4, 5, 6, 10 and 11.

Thus, although overall there was a significant difference in accuracy of recognition of emotion by middle class and working class children, when broken down by age the difference only reached

Table IV.23: T-tests: Recognition of male and female portrayals of emotion by middle class and working class children

	N			Female Face				Male Face			
				Means				Means			
Age	M.C.	W.C.	df	Working Class	Middle Class	t-value	one-tailed sig.	Working Class	Middle Class	t-value	one-tailed sig.
3	13	11	22	0.636	2.385	-3.45	0.001	1.545	2.308	-1.39	n.s.
4	26	21	45	1.952	3.154	-2.21	0.016	1.571	2.231	-1.89	0.032
5	28	30	56	3.267	3.821	-1.10	n.s.	1.767	2.886	-3.02	0.002
6	35	32	65	4.094	4.714	-1.63	n.s.	3.250	4.000	-1.91	0.035
7	33	33	64	4.485	5.030	-1.56	n.s.	4.394	4.333	0.17	n.s.
8	39	39	74	5.256	5.051	0.74	n.s.	4.692	4.923	-0.76	n.s.
9	32	13	43	5.231	5.687	-1.35	n.s.	5.230	5.125	0.28	n.s.
10	35	25	58	5.280	5.514	-0.93	n.s.	5.050	5.514	-1.73	0.044
11	21	23	42	5.391	5.381	0.03	n.s.	4.478	5.667	-2.71	0.005

significance in recognition of female portrayals of emotion at age 3 and 4, and at age 4, 5, 6, 10 and 11 for male portrayals of emotion.

Social Class and Recognition of emotion in parts of the face

The mean number of emotions correctly identified by middle class and working class children in parts of the face were calculated, and are presented in graph form in Fig. IV.6. This shows that middle class and working class children recognized emotion in the noses with almost equal accuracy, though the working class children performed more erratically than middle class children. While four and five year olds of both classes recognized emotion in the eyes with equal accuracy, between 6 and 11 the middle class children consistently recognized emotion in the eyes more accurately than working class children. The middle class children recognized emotion in the mouths more accurately than working class children at each age except 7.

Age was again recoded to three groups and a two-way analysis of variance of age and social class (as defined by school) applied.

Table IV.24: Analysis of variance: Accuracy of recognition of emotion in parts of the face by age and social class

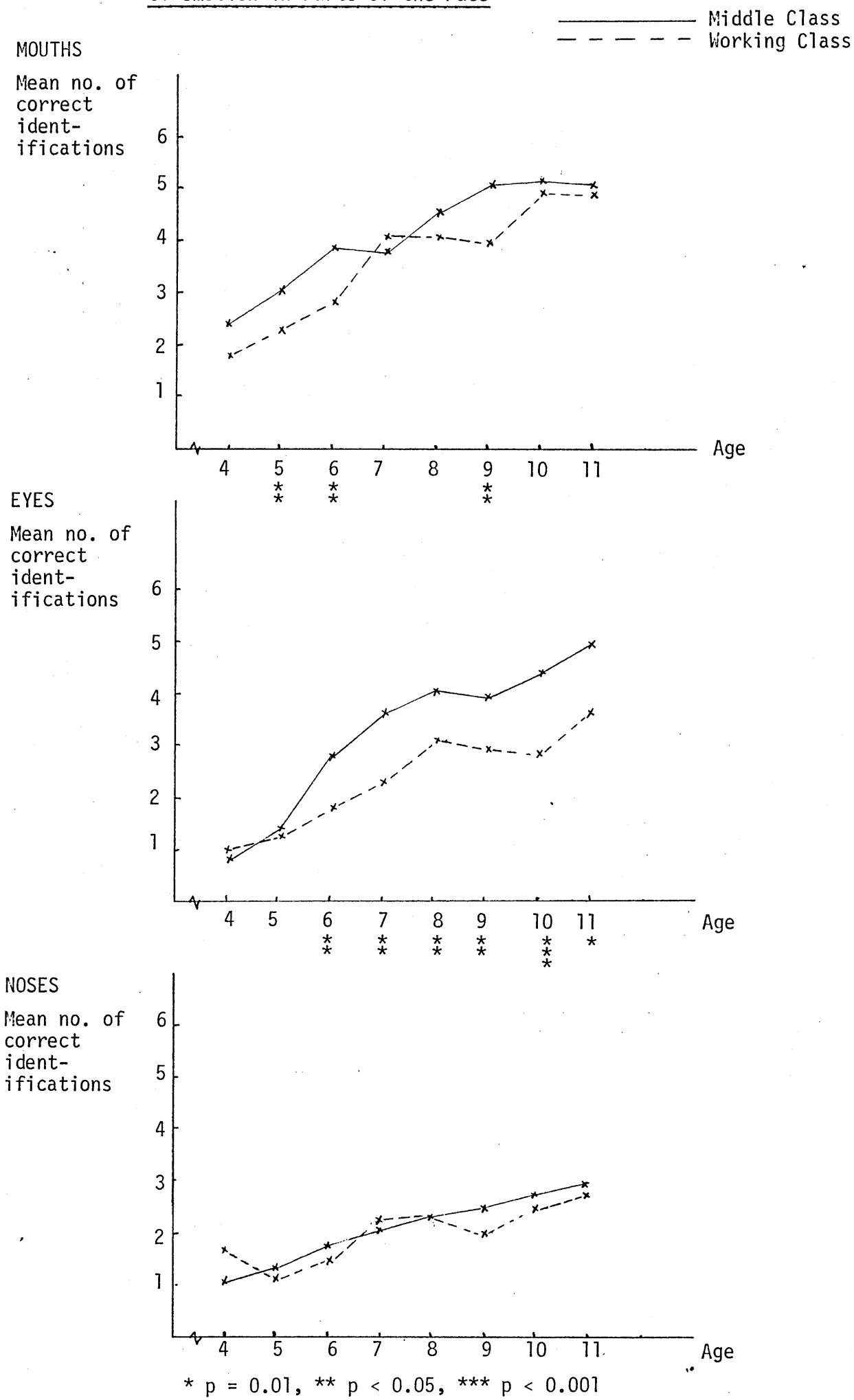
Source of Variation	Sum of Squares	df	Mean Square	F	Sig.
Mouths					
Main Effects	360.148	3	120.049	53.804	0.001
Age	326.554	2	165.277	73.178	0.001
Social Class	21.439	1	21.439	9.609	0.002
2-way Interactions	0.923	2	0.461	0.207	0.813
Age x Social Class	0.923	2	0.461	0.207	0.813
Explained	361.071	5	72.214	32.365	0.001
Residual	977.278	438	2.231		
Total	1338.349	443	3.021		

Source of Variation	Sum of Squares	df	Mean Square	F	Sig.
Eyes					
Main Effects	458.395	3	152.798	53.536	0.001
Age	348.077	2	174.039	60.978	0.001
Social Class	89.245	1	89.245	31.269	0.001
2-way Interactions	21.185	2	10.593	3.711	0.025
Age x Social Class	21.185	2	10.593	3.711	0.025
Explained	479.580	5	95.916	33.606	0.001
Residual	1250.095	438	2.854		
Total	1729.675	443	3.904		
Noses					
Main Effects	107.567	3	35.856	22.508	0.001
Age	103.910	2	51.955	32.614	0.001
Social Class	1.633	1	1.633	1.025	0.312
2-way Interactions					
Age x Social Class	0.339	2	0.169	0.106	0.899
	0.339	2	0.169	0.106	0.899
Explained	107.905	5	21.581	13.547	0.001
Residual	697.741	438	1.593		
Total	805.646	443	1.819		

Thus recognition of emotion in mouths and eyes varies significantly with both age and social class. Although there was no significant two-way interaction in recognition of emotion in mouths, there was a significant two-way interaction in recognition of eyes (Age by Social Class) and this will be discussed below. There was no significant social class difference in recognition of emotion in noses.

T-tests were applied to the mean number of emotions correctly identified in each part of the face by middle class and working class children of each age (Table IV.25).

Fig. IV.6: Middle Class and Working Class children: Recognition of emotion in Parts of the Face



* p = 0.01, ** p < 0.05, *** p < 0.001

Table IV.25: T-tests: Recognition of emotion in parts of the face by middle class and working class children

Age	N W.C.	N M.C.	Working Class Mean	Middle Class Mean	t-value	df	sig.
Mouths							
4	12	15	1.833	2.400	-1.20	25	n.s.
5	30	28	2.367	3.071	1.72	56	0.04
6	32	35	2.875	3.914	2.74	65	0.004
7	33	33	4.152	3.818	-0.86	64	n.s.
8	39	38	4.103	4.684	1.67	76	0.05
9	13	32	4.000	5.125	2.27	43	0.014
10	25	35	5.000	5.229	0.71	58	n.s.
11	23	21	5.043	5.143	0.28	42	n.s.
Eyes							
4	12	15	1.000	0.933	-0.28	25	n.s.
5	30	28	1.367	1.464	0.15	56	n.s.
6	32	35	1.844	2.914	2.82	65	0.003
7	33	33	2.364	3.606	2.66	64	0.005
8	39	38	3.128	4.053	2.39	75	0.008
9	13	32	2.924	3.969	1.70	43	0.04
10	25	35	2.880	4.429	3.48	58	0.0005
11	23	21	3.609	4.905	2.39	42	0.01
Noses							
4	12	15	1.750	1.133	-1.29	25	n.s.
5	30	28	1.233	1.464	1.37	56	n.s.
6	32	35	1.500	1.886	1.26	65	n.s.
7	33	33	2.363	2.212	-0.44	64	n.s.
8	39	38	2.359	2.395	0.13	76	n.s.
9	13	32	2.077	2.531	1.09	43	n.s.
10	25	35	2.520	2.800	0.88	58	n.s.
11	23	21	2.913	3.095	0.51	42	n.s.

Inspection of Table IV.25 indicates that although the difference in working class and middle class children's ability to recognize emotion in the eyes is significant between the ages of 6 and 11; in recognition of emotion in the mouths, middle class children performed significantly more accurately than working class children only at ages 5, 6, 8 and 9. There were no significant class differences in ability to identify emotions in the noses.

The results obtained thus indicate that overall middle class children do recognize emotion more accurately than working class children - particularly in recognition of the more subtle cues to

identification of emotion in the eyes. When broken down by age, the difference in recognition ability of middle class and working class children reached significance only at age 3 and 4 for female portrayals. In recognition of emotion portrayed by the male, middle class children performed more accurately at age 4, 5, 6, 10 and 11. No significant differences were found in recognition of emotion in noses. However, in recognition of emotion in mouths, middle class children performed significantly more accurately at age 5, 6, 8 and 9, and in recognition of emotion in eyes at each age between 6 and 11.

HYPOTHESIS 9: First born children will recognize emotion more accurately than later born children of the same age.

HYPOTHESIS 10: Only children will recognize emotion more accurately than children of the same age from families containing more than one child.

Recognition of emotion in the whole face by first and later born children

The means of the number of correct identifications of male and female portrayals of emotion were calculated for first born and later born children of each age, and are presented in graph form in Fig. IV.7. From these graphs it can be seen that levels of recognition of emotion were very similar for first born and later born children.

Age was again recoded to three groups and analysis of variance applied. Since Hypotheses 9 and 10 were closely related both birth order and presence/absence of siblings were entered - the results relating to birth order will be summarized first.

From Table IV.26 it can be seen that there were no significant differences in ability to recognize emotion by first or later born children. There were no significant interactions between birth order and age though there was, as expected, a significant interaction between age and number of siblings.

Fig. IV.7: First/Later born children and recognition of emotion in the whole face

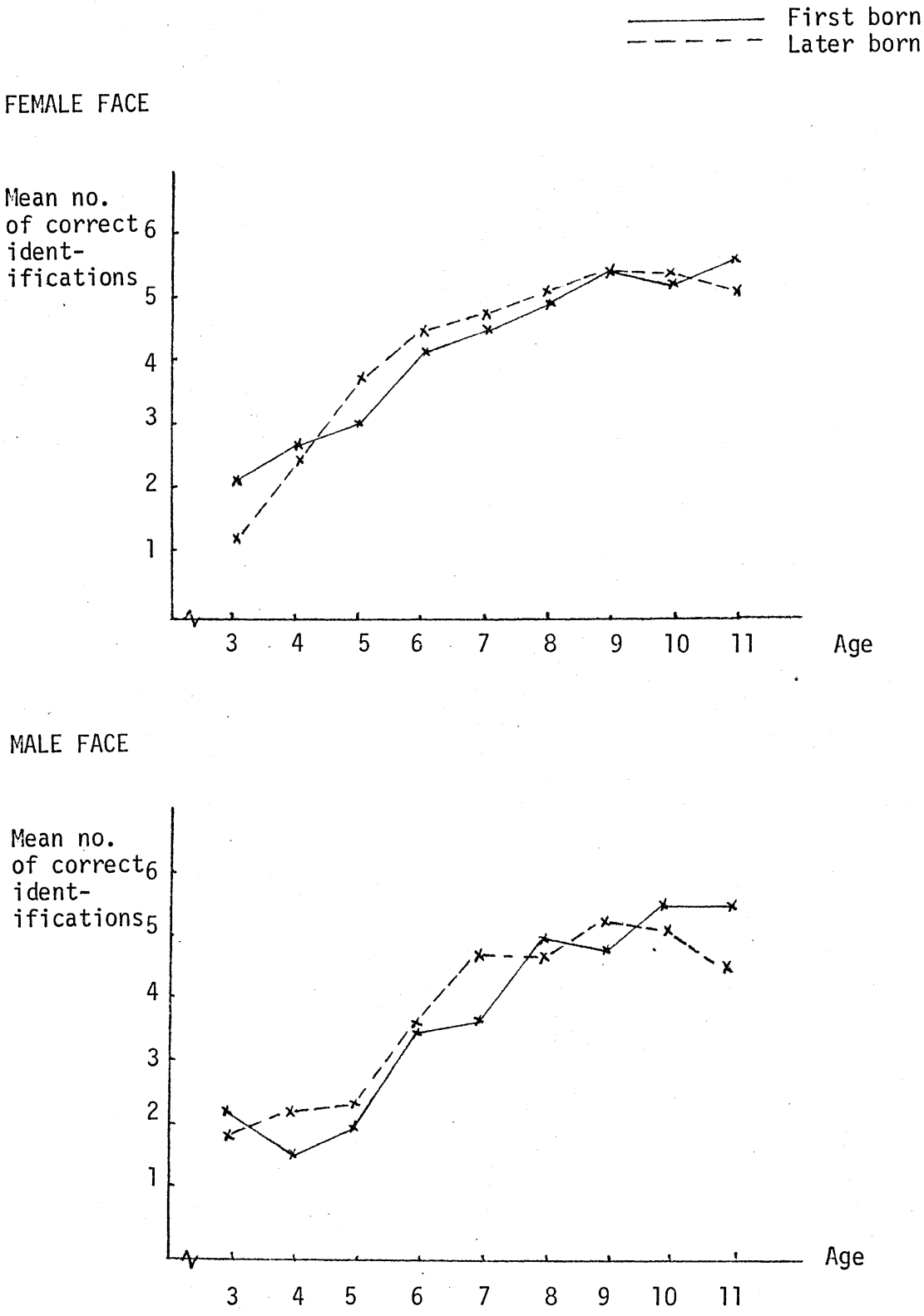


Table IV:26: Analysis of Variance: Recognition of emotion in whole face by age, birth order and presence/absence of siblings

Source of Variation	Sum of Squares	df	Mean Square	F	sig.
Female Face					
Main Effects	516.609	4	129.152	58.935	0.001
Age	501.228	2	250.614	114.360	0.001
Sibs	5.186	1	5.186	2.367	0.125
Pos	0.203	1	0.203	0.092	0.761
2-way Interactions	17.521	4	4.380	1.999	0.094
Age x Sibs	15.926	2	7.963	3.634	0.027
Age x Pos	4.690	2	2.345	1.070	0.344
Explained	534.129	8	66.766	30.467	0.001
Residual	1051.895	480	2.191		
Total	1586.024	488	3.250		
Male Face					
Main Effects	704.918	4	176.229	91.937	0.001
Age	696.219	2	348.110	181.606	0.001
Sibs	0.432	1	0.432	0.225	0.635
Pos	1.500	1	1.500	0.783	0.377
2-way Interactions	27.899	4	6.975	3.639	0.006
Age x Sibs	20.812	2	10.406	5.429	0.005
Age x Pos	6.900	2	3.450	1.800	0.166
Explained	732.817	8	91.602	47.788	0.001
Residual	920.083	480	1.917		
Total	1652.900	488	3.387		

Sibs = presence/absence of siblings
Pos = first/later born

Recognition of emotion in parts of the face by first and later born children

Age was again recoded to three groups and analysis of variance by age, presence/absence of siblings and birth order applied (Table IV.27). Results relating to first/later born children will be summarized first.

Table IV.27: Analysis of Variance: Recognition of Emotion in parts of the face by age, birth order and presence/absence of siblings

Source of Variation	Sum of Squares	df	Mean Square	F	sig.
Mouths					
Main Effects	339.945	4	84.986	37.369	0.001
Age	339.152	2	169.576	74.365	0.001
Sibs	0.390	1	0.390	0.172	0.679
Pos	1.184	1	1.184	0.521	0.471
2-way Interactions	9.100	4	2.275	1.000	0.407
Age x Sibs	8.709	2	4.354	1.915	0.149
Age x Pos	3.087	2	1.543	0.679	0.508
Explained	349.045	8	43.631	19.184	0.001
Residual	989.304	435	2.274		
Total	1338.349	443	3.021		
Eyes					
Main Effects	373.678	4	93.419	30.091	0.001
Age	370.254	2	185.127	59.631	0.001
Sibs	1.590	1	1.590	0.512	0.475
Pos	4.268	1	4.268	1.375	0.242
2-way Interactions	5.519	4	1.380	0.444	0.776
Age x Sibs	2.237	2	1.119	0.360	0.698
Age x Pos	4.495	2	2.247	0.724	0.485
Explained	379.197	8	47.000	15.268	0.001
Residual	1350.479	435	3.105		
Total	1729.676	443	3.904		
Noses					
Main Effects	116.981	4	29.245	18.530	0.001
Age	107.649	2	53.824	34.104	0.001
Sibs	5.480	1	5.480	3.472	0.063
Pos	9.456	1	9.456	5.991	0.015
2-way Interactions	2.124	4	0.531	0.336	0.853
Age x Sibs	1.396	2	0.698	0.442	0.643
Age x Pos	1.013	2	0.506	0.321	0.726
Explained	119.104	8	14.888	9.433	0.001
Residual	686.542	435	1.578		
Total	805.646	443	1.819		

Sibs = presence/absence of siblings
Pos = first/later born

There were thus no significant differences in accuracy of recognition in the mouths and eyes by first born and later born children. In recognition of emotion in the noses, contrary to prediction, later born children performed significantly more accurately than first born children.

Thus the hypothesis that first born children would identify emotion more accurately than later born children of the same age was not confirmed. Later born children recognized emotion in the noses significantly more accurately than first born children.

Recognition of emotion in the whole face by only children and children with siblings

Inspection of Table IV.26 indicates that there was no significant difference in accuracy of recognition of emotion in the whole face by only children and children with siblings.

Recognition of emotion in parts of the face by only children and children with siblings

From Table IV.27 it can be seen that there was no significant difference in accuracy of recognition of emotion in parts of the face by only children and children with siblings.

The hypothesis that only children would recognize emotion more accurately than children with siblings was therefore not confirmed.

HYPOTHESIS 11: The most popular children will be the most accurate judges of emotion

Popularity and recognition of emotion in the whole face

In the present study subjects were classified as overchosen, average chosen, under-chosen or not chosen by their classmates. Pearson Correlation Coefficients were calculated between number of accurate identifications of emotion in the whole male or female face (varying from 0 - 6) and the four levels of popularity score. The Coefficients

were calculated for each age. Since there was no correlation between age and popularity, coefficients were also calculated between the accuracy scores and popularity scores for all children for whom popularity scores had been obtained (Table IV.28).

Table IV.28: Popularity and recognition of emotion in the whole face: Pearson Correlation Coefficients

Age	N	Female Faces	Male Faces
4	47	0.075	0.214
5	58	-0.005	-0.037
6	67	0.242*	0.211*
7	66	0.198*	0.195*
8	78	-0.082	-0.086
9	45	0.157	0.255*
10	60	-0.002	-0.093
11	44	-0.107	0.314*
	465	0.442**	0.351**

* $p < 0.05$
** $p < 0.001$

From Table IV.28 it can be seen that a substantial overall relationship exists between popularity and recognition scores (with the correlation being significant at $p < 0.001$ level for both the male and female face). However when broken down by age there is no consistent pattern emerging.

Popularity and recognition of emotion in parts of the face

Pearson Correlation Coefficients were calculated between accuracy of recognition of emotion in parts of the face (using data from children who identified emotion in all three parts) and popularity scores (Table IV.29).

Inspection of Table IV.29 shows that there is a substantial overall relationship between accuracy of recognition of emotion in mouths and popularity scores ($p < 0.001$). There was a very low, but significant, correlation between popularity scores and accuracy of recognition of emotions in noses, and a non-significant correlation between popularity

scores and accuracy of recognition of emotion in eyes. Again, however, when broken down by age, no consistent pattern emerges.

Table IV.29: Popularity and recognition of emotion in parts of the face: Pearson Correlation Coefficients

Age	N	Mouths	Eyes	Noses
4	27	-0.127	0.036	0.260
5	58	0.085	-0.038	0.160
6	67	-0.014	-0.099	0.124
7	66	0.260	0.110	0.169
8	77	-0.017	0.044	-0.028
9	45	0.059	-0.100	0.026
10	60	-0.034	0.046	-0.115
11	44	0.103	0.253*	0.249*
	444	0.336**	0.050	0.090*

* $p < 0.05$

** $p < 0.001$

The hypothesis that the most popular children will be the most accurate judges of emotion was therefore confirmed for recognition of emotion in the whole face, although when analyzed by age the relationship was not consistent. However, the results obtained suggest that the relationship between popularity and ability to recognize emotion in the whole face is particularly strong at ages 6 and 7.

In recognition of emotion in parts of the face, significant correlations were found for the whole sample between popularity and recognition of emotion in mouths and noses. A significant correlation was obtained between popularity and recognition of emotion in the eyes among 11 year olds, though not for the whole sample of children.

HYPOTHESIS 12: Girls will recognize emotions more accurately than boys.

Sex and recognition of emotion in the whole face

Age was again recoded to three groups (3 to 5, 6 to 8 and 9 to 11 year olds) and a two-way analysis of variance (Age by Sex) applied (Table IV.30).

Table IV.30: Analysis of variance: Accuracy of recognition of emotion in the whole face by age and sex of subject

Source of Variation	Sum of Squares	df	Mean Squares	F	sig.
Female Face					
Main Effects	510.615	3	170.205	77.339	0.001
Age	509.224	2	254.612	115.693	0.001
Sex	1.281	1	1.281	0.582	0.446
2-way Interactions	12.444	2	6.222	2.827	0.060
Age x Sex	12.444	2	6.222	2.827	0.060
Explained	523.059	5	104.612	47.534	0.001
Residual	1062.966	483	2.201		
Total	1586.025	488	3.250		
Male Face					
Main Effects	702.973	3	234.324	119.338	0.001
Age	688.276	2	344.138	175.265	0.001
Sex	1.064	1	1.064	0.542	0.462
2-way Interactions	1.541	2	0.770	0.392	0.676
Age x Sex	1.541	2	0.770	0.392	0.676
Explained	704.514	5	140.903	71.760	0.001
Residual	948.386	483	1.964		
Total	1652.900	488	3.387		

Thus, contrary to prediction, accuracy of recognition of emotion in the male and female faces did not vary significantly with sex of subject. There were no significant interactions of age and sex.

Sex and recognition of emotion in parts of the face

Age was again recoded to three groups and a two-way analysis of variance (Age by Sex) applied (Table IV.31).

Table IV.31: Analysis of variance: Accuracy of recognition of emotion in parts of the face by age and sex of subject

Source of Variation	Sum of Squares	df	Mean Square	F	sig.
Mouths					
Main Effects	341.031	3	113.677	50.021	0.001
Age	320.249	2	160.124	70.460	0.001
Sex	2.322	1	2.322	1.022	0.313
2-way Interactions	1.932	2	0.966	0.425	0.654
Age x Sex	1.932	2	0.966	0.425	0.654
Explained	342.963	5	68.593	30.183	0.001
Residual	995.386	438	2.273		
Total	1338.349	443	3.021		
Eyes					
Main Effects	395.914	3	131.971	43.499	0.001
Age	329.591	2	164.796	54.318	0.001
Sex	26.764	1	26.764	8.822	0.003
2-way Interactions	4.908	2	2.454	0.809	0.446
Age x Sex	4.908	2	2.454	0.809	0.446
Explained	400.822	5	80.164	26.423	0.001
Residual	1328.853	438	3.034		
Total	1729.675	443	3.904		
Noses					
Main Effects	110.703	3	36.901	23.352	0.001
Age	95.742	2	47.971	30.357	0.001
Sex	4.769	1	4.769	3.018	0.083
2-way Interactions	2.807	2	1.403	0.888	0.412
Age x Sex	2.807	2	1.403	0.888	0.412
Explained	113.510	5	22.702	14.366	0.001
Residual	692.136	438	1.580		
Total	805.646	443	1.819		

Thus only in recognition of emotion in eyes do girls perform significantly more accurately than boys. There were no significant two-way interactions between age and sex.

Sex of Subject/Sex of Portrayer

The average ages of the 234 girls and 255 boys who were tested were 7.5 years and 6.9 years respectively. It would have been meaningless to use X^2 on a 2-by-2 sex of subject/sex of portrayer table since it would be expected that girls, being older, would recognize both male and female portrayals of emotion more accurately than boys. T-tests were applied to the mean of the number of emotions correctly identified, in each set of photographs, by boys and girls to investigate the difference in performance in each set. Table IV.31 showed that with age statistically corrected, girls recognized emotion in the eyes significantly more accurately than boys.

Table IV.32: Sex and accuracy of recognition of emotion

	Female	Male	Mouths	Eyes	Noses
Girls (N = 234)	4.5342	4.1667 *	4.2667 **	2.2810 ****	2.3524 ***
Boys (N = 255)	4.4336	3.8281	3.8426	2.6213	1.9915

* p = 0.04
** p = 0.01
*** p = 0.005
**** p < 0.001

Table IV.32 shows that, despite the overall age difference, there was no significant difference in girls' and boys' ability to recognize emotion in the female face. However, the difference between girls' and boys' recognition of emotion in the male face was significant. ($t = 2.04$, $df = 488$, $p = 0.04$). At first sight, this would appear to suggest that in recognition of female emotion the six month average age difference in favour of girls is compensated for by some factor related to sex of subject. It would, however, be unwise to make such an assumption. Inspection of Table IV.1 shows that the standard deviation for recognition of female portrayals of emotion drops regularly with age, while that for recognition of male portrayals of emotion does not. Recognition of female portrayals is thus approaching

the "ceiling" more quickly than recognition of male portrayals.

In recognition of emotion in parts of the face the significance of the difference in means varies, and the difference is highly significant for recognition of emotion in the eyes ($t = 4.11$, $df = 443$, $p < 0.001$). These results indicate that it is in the more difficult judgments of emotion that differences in performance of boys and girls in the present study become clearer - though maturational factors cannot be ignored and will be discussed below.

The hypothesis that girls would be better at recognizing emotion than boys was not generally confirmed. When age was controlled it was only in recognition of emotion in the eyes that girls performed significantly better than boys.

HYPOTHESIS 13: There is a relationship between personality and ability to recognize emotion. More specifically it is hypothesized that Extraversion will be positively related to accuracy of recognition of emotion and Neuroticism will be negatively related.

Extraversion/Neuroticism and recognition of emotion in the whole face

Preliminary analysis of the data indicated that there was a significant positive correlation between age and Extraversion scores as measured by the Junior Eysenck Personality Inventory ($r = 0.19$, $p = 0.001$). There was also a significant negative correlation between age and Neuroticism scores ($r = -0.12$, $p = 0.018$). Pearson Correlation Coefficients were calculated between Extraversion and Neuroticism scores and recognition of emotion in the whole face for each age but, due to the correlation with age, not for the total number of children who completed the personality test.

Table IV.33: Extraversion/Neuroticism and recognition of emotion in the whole face: Pearson Correlation Coefficients

		Extraversion		Neuroticism	
Age	N	Female Face	Male Face	Female Face	Male Face
6	20	-0.04	0.32	-0.21	-0.03
7	54	0.30*	-0.01	0.13	0.21
8	77	-0.02	-0.04	-0.15	-0.10
9	45	0.27*	0.16	0.27*	0.38**
10	57	0.13	0.04	0.07	0.14
11	37	0.28*	0.07	0.03	0.24

* $p < 0.05$

** $p < 0.005$

The correlations obtained were scattered and no consistent pattern emerged. In recognition of female portrayals of emotion the correlation between Extraversion and accuracy was, as predicted, positive and significant at ages 7, 9 and 11. In recognition of male portrayals of emotion none of the correlations between Extraversion scores and accuracy reached significance. The only significant correlations between Neuroticism scores and accuracy were, against prediction, positive at age 9 for recognition of both male and female portrayals of emotion.

Age was recoded to two groups (6 to 8, and 9 to 11 year olds) and the raw Extraversion and Neuroticism scores were recoded to three groups of average, high and low scores. (Extraversion: High = 20-24, Average = 16-19, Low = 1-15. Neutoricism: High = 19 to 24, Average = 11 to 18, Low = 2 to 10.) The recoded values for age, Extraversion and Neuroticism were entered in a three-way analysis of variance (Table IV.34).

Extraversion and recognition of emotion in the whole face: From Table IV.34 it can be seen that recognition of emotion in the whole female face did vary significantly with Extraversion scores - and, as predicted, the relationship was positive. Accuracy of recognition of emotion in the male face did not vary significantly with Extraversion scores. There were no significant two-way or three-way interactions.

Table IV.34: Analysis of variance: Accuracy of recognition of emotion in the whole face by age, Extraversion and Neuroticism

Source of Variation	Sum of Squares	df	Mean Square	F	sig.
Female Face					
Main Effects	24.285	5	4.857	3.940	0.002
Age	13.006	1	13.006	10.550	0.001
Extraversion	7.662	2	3.831	3.108	0.046
Neuroticism	1.590	2	0.795	0.645	0.525
2-way Interactions	11.584	8	1.448	1.175	0.314
Age x Extraversion	4.223	2	2.112	1.713	0.182
Age x Neuroticism	1.152	2	0.576	0.467	0.627
Extraversion x Neuroticism	5.369	4	1.342	1.089	0.362
3-way Interactions	3.941	4	0.985	0.799	0.526
Age x Extraversion x Neuroticism	3.941	4	0.985	0.799	0.526
Explained	39.810	17	2.342	1.900	0.018
Residual	335.294	272	1.233		
Total	375.104	289	1.298		
Male Face					
Main Effects	23.859	5	4.772	2.817	0.017
Age	18.985	1	18.985	11.208	0.001
Extraversion	1.092	2	0.546	0.322	0.725
Neuroticism	5.242	2	2.621	1.547	0.215
2-way Interactions	19.146	8	2.393	1.413	0.191
Age x Extraversion	1.447	2	0.723	0.427	0.653
Age x Neutoricism	5.451	2	2.726	1.609	0.202
Extraversion x Neutoricism	11.222	4	2.805	1.656	0.160
3-way Interactions	3.436	4	0.859	0.507	0.730
Age x Extraversion x Neuroticism	3.436	4	0.859	0.507	0.730
Explained	46.442	17	2.732	1.613	0.061
Residual	460.734	272	1.694		
Total	507.176	289	1.755		

Neuroticism and recognition of emotion in the whole face: From Table IV.34 it can be seen that accuracy of recognition of emotion in the male and female face did not vary significantly with Neuroticism scores. There were no significant two-way or three-way interactions.

Extraversion/Neuroticism and recognition of emotion in parts of the face

Pearson Correlation Coefficients were calculated between Extraversion and Neuroticism scores and accuracy of recognition of emotion in parts of the face. Correlations were not calculated for the whole sample together due to the significant correlation with age.

Table IV.35: Extraversion/Neuroticism and recognition of emotion in parts of the face: Pearson Correlation Coefficients

		Extraversion			Neuroticism		
Age	N	Mouths	Eyes	Noses	Mouths	Eyes	Noses
6	20	0.06	0.23	0.07	0.06	-0.14	-0.24
7	54	0.01	0.03	0.01	-0.07	0.10	-0.03
8	77	0.13	0.07	-0.21*	-0.01	-0.19*	0.06
9	45	-0.03	0.28*	0.08	-0.19	-0.10	-0.08
10	57	0.15	0.14	0.27*	-0.13	-0.06	-0.16
11	37	-0.04	0.21	0.10	0.08	0.12	0.19

* $p < 0.05$

Thus the only significant correlations between Extraversion scores and accuracy of recognition of emotion in parts of the face were negative at age 8 (in recognition of emotion in noses), and positive at both age 9 (in recognition of emotion in eyes), and 10 (in recognition of emotion in noses). Only one of the correlations with Neuroticism reached significance - for recognition of emotion in eyes at age 8. This correlation was, as predicted, negative. Age, Extraversion and Neuroticism were again recoded and a three-way analysis of variance applied. (Table IV.36).

Extraversion and recognition of emotion in parts of the face: From Table IV.36 it is apparent that it was only in recognition of emotion in eyes that accuracy varied significantly with Extraversion scores. From Table IV.35 it can be seen that, as predicted, the relationship between Extraversion and accuracy of recognition of emotion in the eyes was positive. There was a significant two-way interaction between age and Extraversion scores in recognition of noses.

Table IV.36: Analysis of variance: Accuracy of recognition of emotion in parts of the face by age, Extraversion and Neuroticism

Source of Variation	Sum of Squares	df	Mean Square	F	sig.
Mouths					
Main Effects	37.742	5	7.548	3.846	0.002
Age	28.941	1	28.941	14.748	0.001
Extraversion	1.126	2	0.563	0.287	0.751
Neuroticism	3.948	2	1.974	1.006	0.367
2-way Interactions	14.792	8	1.849	0.942	0.482
Age x Extraversion	1.792	2	0.896	0.457	0.634
Age x Neuroticism	0.373	2	0.186	0.095	0.909
Extraversion x Neuroticism	12.718	4	3.179	1.620	1.169
3-way Interactions	6.393	4	1.598	0.814	0.517
Age x Extraversion x Neutoricism	6.393	4	1.598	0.814	0.517
Explained	58.926	17	3.466	1.766	0.032
Residual	531.807	271	1.962		
Total	590.733	288	2.051		
Eyes					
Main Effects	54.869	5	10.974	3.168	0.008
Age	14.126	1	14.126	4.078	0.044
Extraversion	33.299	2	16.650	4.807	0.009
Neutoricism	1.038	2	0.519	0.150	0.861
2-way Interactions	23.200	8	2.900	0.837	0.570
Age x Extraversion	4.092	2	2.046	0.591	0.555
Age x Neuroticism	5.185	2	2.592	0.748	0.474
Extraversion x Neuroticism	14.514	4	3.629	1.048	0.383
3-way Interactions	10.005	4	2.501	0.722	0.577
Age x Extraversion x Neuroticism	10.005	4	2.501	0.722	0.577
Explained	88.074	17	5.181	1.496	0.095
Residual	938.638	271	3.464		
Total	1026.712	288	3.565		
Noses					
Main Effects	5.331	5	1.066	0.692	0.630
Age	3.746	1	3.746	2.433	0.120
Extraversion	0.057	2	0.029	0.019	0.982
Neuroticism	0.805	2	0.402	0.261	0.770
2-way Interactions	27.248	8	3.406	2.212	0.027
Age x Extraversion	17.870	2	8.935	5.803	0.003
Age x Neuroticism	5.888	2	2.944	1.912	0.150
Extraversion x Neuroticism	6.634	4	1.659	1.077	0.368
3-way Interactions	2.116	4	0.529	0.344	0.848
Age x Extraversion x Neuroticism	2.116	4	0.529	0.344	0.848
Explained	34.695	17	2.041	1.326	0.176
Residual	417.243	271	1.540		
Total	451.938	288	1.569		

Neuroticism and recognition of emotion in parts of the face:

Table IV.36 shows that recognition of emotion in mouths, eyes and noses did not vary significantly with Neuroticism scores. There were no significant two-way or three-way interactions.

The hypothesis that Extraversion scores would be positively related to accuracy of recognition of emotion was confirmed for recognition of emotion in the whole female face and in the eyes. The hypothesis that Neuroticism would be negatively related to accuracy of recognition of emotion was not confirmed.

HYPOTHESIS 14: The part of the face from which children find it easiest to recognize emotion will vary from emotion to emotion.

In order to establish from which part of the face children found it easiest to identify each emotion the number of accurate judgments of each emotion in each part of the face was calculated using only data from subjects who had completed recognition of emotion in all three parts. X^2 was used to determine if the distribution of correct responses was significantly different from that expected by chance (Table IV.37).

Table IV.37: Frequency of accurate judgment of each emotion in each part of the female face

Emotion	Mouths	Eyes	Noses	X^2	Level of Significance
Happiness	424	244	222	82.71	0.001
Disgust	279	181	323	40.49	0.001
Sadness	341	282	137	87.12	0.001
Anger	276	217	68	122.90	0.001
Surprise	248	204	106	56.82	0.001
Fear	224	196	105	44.24	0.001

(N = 444)

The general order of difficulty of the area was mouths, eyes and noses, with the exception of Disgust which, as expected, was most accurately identified from the nose alone.

The hypothesis that the part of the face from which children find it easiest to recognize emotion will vary from emotion to emotion was thus partially confirmed. Although not all emotions were most easily identified from the same part of the face, there was not as much variation as expected on the basis of previous research.

HYPOTHESIS 15: The types of errors made in recognition of emotion in parts of the face will reflect the types of error made in recognition of emotion in the whole face.

The number of times each emotion was chosen in error for each of the remaining emotions was calculated for each part of the face (Table IV.38). To investigate whether the distribution was significantly different from that expected by chance X^2 was used.

Table IV.38: Total errors made in recognition of emotion in parts of the face

	Emotion to be selected	Emotion selected: H	D	Sd	A	Sp	F	X^2
Mouths	Happiness(H)	-	8	6	7	11	9	1.08
	Disgust (D)	11	-	65	88	12	13	138.39**
	Sadness(Sd)	6	50	-	35	25	15	44.76**
	Anger (A)	8	100	34	-	29	30	122.03**
	Surprise (Sp)	38	14	14	21	-	141	255.70**
	Fear (F)	19	31	31	41	129	-	154.84**
Eyes	Happiness	-	49	21	58	50	20	31.66**
	Disgust	38	-	52	100	42	31	57.28**
	Sadness	38	48	-	24	20	30	15.76*
	Anger	22	81	34	-	46	43	43.36**
	Surprise	34	33	23	28	-	121	141.14**
	Fear	47	40	45	29	85	-	36.67**
Noses	Happiness	-	38	52	42	36	52	5.26
	Disgust	23	-	12	18	40	28	18.88**
	Sadness	47	20	-	72	96	72	54.80*
	Anger	64	51	81	-	80	98	19.83**
	Surprise	52	22	83	101	-	80	56.32**
	Fear	41	18	81	121	75	-	93.34

* $p < 0.01$

** $p < 0.001$

From Table IV.38 it is concluded that errors made in judging emotion in parts of the face were not random. The most common confusions are set out below with the most common confusions made in recognition of emotion in the whole face (extracted from Table IV.10) added for comparison.

Table IV.39: Emotions most often confused in recognition of emotion in parts of the face

	Mouths	Eyes	Noses	Whole Female Face
Happiness	Surprise	Anger	Sadness/Fear	Surprise
Disgust	Anger	Anger	Surprise	Anger
Sadness	Disgust	Disgust	Surprise	Disgust/Anger
Anger	Disgust	Disgust	Fear	Disgust
Surprise	Fear	Fear	Anger	Fear
Fear	Surprise	Surprise	Anger	Surprise

Thus the confusions made in judging emotions in the mouths and eyes were very similar to those in the whole face. The pattern of confusions in recognizing emotions in the noses varies substantially from both confusions in the other parts of the face and in the whole face, thus reflecting the more difficult nature of this part of the task.

It can be further noted from Table IV.38 that, except for Happiness, the errors made in recognition of emotions portrayed in the mouths were more systematic than those made in recognition of emotions in the eyes.

Age and errors in recognition of emotion in parts of the face

The total errors presented in Table IV.38 were broken down by age. Since the youngest children did not identify emotion in all three parts of the face, the age groupings in this case were: 4 to 5 years (N=84), 6 to 8 years (N = 209) and 9 to 11 years (N=149). X^2 was used to identify if the spread of incorrect choices was significantly different from that expected by chance (Table IV.40).

Table IV.40: Total errors made in recognition of emotion in female mouth by age

Emotion to be selected	Age	Emotion selected H	D	Sd	A	Sp	F	X^2
Happiness(H)	4-5	-	8	4	7	8	6	0.91
	6-8	-	0	2	0	3	2	-
	9-11	-	0	0	0	0	1	-
Disgust (D)	4-5	8	-	33	20	10	8	29.67*
	6-8	3	-	26	50	2	5	100.85*
	9-11	0	-	6	18	0	0	-
Sadness (Sd)	4-5	5	26	-	24	15	9	25.86*
	6-8	1	20	-	10	9	4	22.53*
	9-11	0	4	-	1	1	2	-
Anger(A)	4-5	7	24	19	-	21	19	7.12
	6-8	1	58	14	-	6	7	125.98*
	9-11	0	18	1	-	2	4	-
Surprise (Sp)	4-5	24	13	10	16	-	26	8.28
	6-8	13	1	3	4	-	78	218.12*
	9-11	1	0	1	1	-	37	124.41*
Fear (F)	4-5	10	22	20	17	26	-	7.57
	6-8	8	11	9	18	66	-	99.87*
	9-11	1	1	2	6	37	-	97.36*

(- indicates cell size too small for calculation of X^2)

* $p < 0.001$

Inspection of Table IV.40 shows that the relative number of errors made decreases with age and that they also become less random. The number of 'empty' cells, or cells with only one or two errors, increases with age indicating decreasing randomness. For recognition of Sadness and Disgust the distribution of errors is significantly different from that expected by chance for even the 4 to 5 year olds.

Inspection of Table IV.41 indicates that as the relative number of errors made in recognition of emotion in eyes decreases with age they also become less random. Although there are no 'empty' cells the number of cells containing only a few errors increases with age.

Table IV.41: Total errors made in recognition of emotion in female eyes by age

Emotion to be selected	Age	Emotion selected: H	D	Sd	A	Sp	F	X^2
Happiness (H)	4-5	-	8	6	21	19	10	14.27*
	6-8	-	22	9	30	24	9	18.87**
	9-11	-	19	6	7	7	1	19.15**
Disgust (D)	4-5	18	-	11	14	9	14	3.56
	6-8	12	-	27	49	24	8	43.09**
	9-11	8	-	14	37	9	9	39.31**
Sadness (Sd)	4-5	12	16	-	11	12	10	1.70
	6-8	15	19	-	12	7	17	14.86*
	9-11	11	13	-	1	1	3	21.39**
Anger (A)	4-5	8	17	15	-	14	12	3.55
	6-8	12	35	17	-	21	21	13.80*
	9-11	2	29	2	-	11	10	45.07**
Surprise (Sp)	4-5	9	17	14	14	-	20	4.51
	6-8	16	12	8	11	-	63	97.01**
	9-11	9	4	1	3	-	38	87.36**
Fear (F)	4-5	16	6	19	8	18	-	11.96
	6-8	25	24	19	13	39	-	17.05*
	9-11	6	10	7	8	28	-	28.53**

* $p < 0.01$
** $p < 0.001$

Table IV.42: Total errors made in recognition of emotion in female noses by age

Emotion to be selected	Age	Emotion selected: H	D	Sd	A	Sp	F	X^2
Happiness (H)	4-5	-	18	13	16	10	10	3.81
	6-8	-	20	26	18	17	24	2.86
	9-11	-	0	13	8	9	18	16.14*
Disgust (D)	4-5	7	-	7	9	20	10	11.05
	6-8	15	-	2	8	18	15	14.59*
	9-11	1	-	3	1	2	3	-
Sadness (Sd)	4-5	21	9	-	10	10	21	10.90
	6-8	17	10	-	33	49	30	32.91*
	9-11	9	1	-	29	37	21	43.88*
Anger (A)	4-5	19	12	22	-	11	12	6.41
	6-8	29	29	31	-	34	55	13.67*
	9-11	16	10	28	-	35	31	21.92*
Surprise (Sp)	4-5	9	17	15	13	-	10	3.50
	6-8	34	5	40	48	-	36	32.73*
	9-11	9	0	28	40	-	34	52.11*
Fear (F)	4-5	12	11	16	24	7	-	11.86
	6-8	14	7	40	57	38	-	55.23*
	9-11	15	0	25	40	30	-	42.28*

* $p < 0.001$

(- indicates cell size too small for calculation of X^2)

The hypothesis that the types of error made in recognition of emotion in parts of the face would reflect the types of error made in recognition of emotion in the whole face was therefore confirmed for recognition of emotion in the mouths and eyes. The pattern of 'common confusions' identified in the nose region did not reflect that found in the other parts of the face. As with recognition of emotion in the whole face, the number of errors made decreased with age and those made were less random.

SUMMARY OF RESULTS

The major findings of the present study can be summarized as follows:

1. Children can match faces on the basis of emotion expression before they can correctly select that emotion in response to being read a short story.

2. Happiness is the first emotion reliably matched, but the order of difficulty of the remaining emotions varies from that found in recognition of emotion.

3. The errors made in emotion matching are not random. A pattern of common confusions can be identified.

4. Accuracy of recognition of emotion in the whole male face and whole female face increases with age, with the increase levelling off around age nine.

5. Happiness is the emotion most easily recognized in the male face; in the female face Happiness and Sadness are the most easily recognized emotions.

6. The errors children made in recognition of emotion in the whole male and whole female face are not random, and a pattern of common confusions can be identified. As age increases, errors are more likely to be of the common confusion type.

7. Children can recognize emotion from just part of the face, and accuracy increases with age.

8. The types of error made in recognition of emotion in parts of the face reflect those made in recognition of emotion in the whole face.

9. In recognition of emotion in parts of the face, Happiness, Sadness, Anger, Surprise and Fear were all identified most easily from the mouth. Disgust was most easily identified from the nose.

10. When data for the whole population of children are taken together, middle class children recognized emotion significantly more accurately than working class children in the female face, the male face, the mouths and eyes. When broken down by age, the difference was significant for the female face at ages 3 and 4, and for the male face at 4, 5 6, 10 and 11. When recognition of emotion in parts of the face was broken down by age, middle class children recognized emotion in the eyes significantly more accurately than working class children between the ages of 6 and 11, and in the mouths at ages 5, 6, 8 and 9.

11. There was no significant difference in accuracy of recognition of emotion by only children and children with siblings.

12. Later born children recognized emotion in noses (the most difficult task) significantly more accurately than first born children.

13. There was a positive correlation between popularity of subject with peers and accuracy of recognition of emotion in the whole male and female face. When analysed by age no consistent pattern of correlation emerged. There was also a significant positive correlation between popularity and recognition of emotion in mouths and noses for the whole population of children, but again no consistent pattern emerged when broken down by age.

14. Boys and girls recognized emotion in the whole male and female face with equal accuracy. Only in recognition of emotion in

the eyes did girls perform significantly more accurately than boys.

15. There was a significant positive correlation between Extraversion scores and accuracy of recognition of emotion in the whole female face and in the eyes. No consistent pattern of correlation emerged when the data were broken down by age. There were no significant correlations between accuracy of recognition of emotion and Neuroticism scores.

CHAPTER V: DISCUSSION AND IMPLICATIONS FOR FUTURE RESEARCH

INTRODUCTION

In Chapter II it was noted that Gates (1923) and Izard (1971) had reported that children's ability to label emotion expressions increased with age. Izard (1971) also noted an age-related increase in emotion recognition. Ekman and Friesen (1971), however, found no developmental trend. The first task of the present study was, therefore, to investigate the relationship between age and the ability to recognize facial emotion. In addition, it was hoped that some insight into how this skill develops could be obtained by comparison of the child's ability to recognize emotion with his ability to match faces on the basis of emotion expression. It was believed additional information about the processes involved might also be gained from identification of the order in which recognition of the emotions appears in the whole face and in parts of the face.

Although analysis of the types of error made in emotion recognition had been carried out in studies of adults' ability to recognize emotion, there had been no reports of such analysis being used in studies with children. The present study analysed the types of error made in recognition of emotion in the whole male and female faces, in parts of the female face and also in emotion matching.

An attempt was also made to gauge what factors are associated with children who are good at recognition of emotion. The relationship between accuracy of recognition of emotion and the following variables was investigated: social class, sex of subject, Extraversion and Neuroticism, popularity with peers, birth order and the presence or absence of siblings.

To facilitate the types of analyses needed to investigate all these areas, a new methodology was developed. This chapter will discuss the findings in the major areas outlined above, and the picture which emerges of the development of children's ability to recognize emotion

will then be discussed. The generality of the findings and the validity of the methodology will also be considered.

THE DEVELOPMENTAL TREND

Growth of ability to recognize emotion in the whole face

The hypothesis that the ability to recognize emotion in the whole face would increase with age was confirmed, thus supporting the results of researchers such as Izard (1971) and Gates (1923). The results contradict those of Ekman and Friesen (1971), who report no developmental trend (though as noted above, this may be due to the methodology used by Ekman and Friesen). As will be discussed later, it is believed the age-related increase in accuracy found in the present study is not an artefact of the new methodology designed.

Fig. IV.1 clearly illustrated the increase in accuracy of recognition of emotion with age. The higher level of recognition of male portrayals of emotion than female portrayals at age 3 was not significant. At 4, 5 and 6 female emotion was recognized significantly more accurately than male emotion. This may indicate that the young child has more opportunity to learn about female emotion than male emotion. Fig. IV.1 showed that as age increases, the accuracy of recognition of male portrayals of emotion 'catches up' with the level for female portrayals. Since male faces were significantly more accurately matched than female faces at age 5 and 6, the lower level of recognition of male emotions at these ages is not due to the male faces being more difficult to analyse.

At age 7 the difference between the mean number of male and mean number of female portrayals of emotion accurately recognized was not significant. However, the difference is significant at 8 and 9 and then becomes non-significant again. If the results for 7 year

olds are omitted then there would be a regular drop in level of significance of the difference from age 5 onwards. This suggests that at age 3 recognition of emotion portrayed by both sexes is so poor that no significant difference can emerge, at 4 the differences begin to emerge and they reach their peak at 5 and 6. The change to group testing around age 7, while not producing a drop in accuracy as compared to the younger groups, may have had a more subtle effect by slightly depressing accuracy of recognition of female portrayals of emotion, which was tested first. Only testing with matched groups of 7 year olds - i.e. one group being tested individually and the other group being tested as a group - could verify whether changing to group procedure does have a significant effect on accuracy of emotion recognition.

From Table IV.1 it can be seen that the Standard Deviation calculated for recognition of emotion at each age decreases regularly with age from age 4 for recognition of female portrayals of emotion, but not for male portrayals. This indicates that even among 11 year olds there are large differences in individual children's ability to recognize male portrayals of emotion - i.e. that recognition of female portrayals of emotion is approaching the 'ceiling' before recognition of male portrayals.

The most striking feature of Fig. IV.4 is that the curve showing recognition of Happiness in the male face is far above the curves for recognition of the other emotions. Only from age 8 onwards do levels of recognition of the other emotions approach the levels for Happiness. This suggests that the young child is given the opportunity to learn to identify Happiness in the male but not the other emotions.

The growth of ability to recognize emotion in parts of the face

Recognition of emotion in parts of the face had not previously been investigated in children. In the present study the hypothesis

that accuracy of recognition of emotion in parts of the face would increase with age was confirmed. From Fig. IV.3 it can be seen that, except at age 4, emotion is most accurately recognized from the mouths, then from the eyes, and finally from the noses. The differences between accuracy of recognition of emotion in mouths and eyes and noses were significant except between eyes and noses at ages 4 and 5. These results reflect the difficulty young children have in making these judgments.

In recognition of Happiness, levels of accuracy in mouths are far above those for eyes and noses, and the level of accuracy for recognition of Happiness in eyes and noses remain very similar throughout. This 'pattern' is not reflected in any other emotion.

Disgust, too, has a distinctive pattern with accuracy highest in the nose region. However, for Sadness, Anger, Surprise and Fear the levels of recognition of emotion in the nose region increase little with age - there are few cues to the emotions in this area of the face, and the cues which are present are very subtle. It is suspected that Happiness was recognized from the nose region due to the creasing around the nose - as noted above it would have been artificial to remove these creases.

Why should accuracy of recognition of facial emotion increase with age? Many plausible hypotheses are possible, such as improved information processing, greater social experience, or learning of verbal labels. Before it is possible to speculate about the nature of the relationship between age and the growth of recognition of emotion, it is necessary to examine in greater detail the process of recognition of emotion through analysis of the order in which recognition of emotion develops, its relationship with emotion matching, the types of errors made in recognition of emotion in the whole face and in

parts of the face, and the characteristics associated with the child who is good at emotion recognition.

The growth of ability to match faces on the basis of emotion expression

The age-related increase in matching was significant for matching of male faces, but not for matching of female faces. Inspection of the means (Table IV.13) indicates that from 3 years old to 5 years old the matching of female faces did become more accurate - but accuracy dropped slightly at age 6 and this remains unexplained. It may be that the older children, who were used to analysis of the female face, were inclined to make hasty decisions as to which faces matched. In the present study children completed the matching task 'in their own time': they were handed the six photographs to match to a set on the table. Handing the photographs to the child one by one at timed intervals would eliminate the possibility of 'hasty errors', but the timing would have to be on the basis of minimim time between photographs to avoid making the task more difficult for slower children.

The difference in accuracy of matching male and female faces was significant only at age 5 and 6. The photographs used were classified by Ekman and Friesen (1971) as being full expressions of the six basic emotions. However, the male and female sets were not equated for difficulty of 'pattern matching' of the various emotions, and for the degree of variability of facial configuration between the various emotions in each set. When the Facial Affect Scoring Technique is more fully developed it may be possible to produce sets matched in this way. It is, at this stage, therefore only possible to suggest that the more accurate matching of the male faces in the present study indicates that, from a 'pattern recognition' point of view, the male face used imposed fewer information processing demands than the female face. Cross-matching male and female portrayals of emotion would remove the problem of one set being more easily analysed than the other. However,

while in matching two identical sets of female or male photographs everything except the emotion expression is constant, in cross-matching a greater degree of analysis and extraction of information would be demanded. It may be that cross-matching could not occur until the child has a greater understanding of emotions.

THE ORDER OF DIFFICULTY OF MATCHING AND RECOGNITION OF EMOTIONS

A major theme running through theories of emotion is that there is a dichotomy between pleasant and unpleasant emotions, and Frijda (1971) suggests that in the adult making a judgment about an emotion expression, that is the first 'decision' made. The concept of judgments being made on the basis of increasingly fine distinctions being drawn may also be found in cognitive theories. It is reasonable to specualte that the young infant is more likely to be in contact with the smiling face of the mother, or other caretaker, than a face showing any other emotion. The infant, too, engages in 'social smiling' and an extensive literature has developed into its causes and nature. In the present study, therefore, it was hypothesized that Happiess would be the first emotion matched and recognized.

The Order of Difficulty of recognition of emotions

From Table IV.7 it can be seen that there were significant differences in accuracy of recognition of the six basic emotions. The order of difficulty suggested by the Pilot Studies was not fully verified - Sadness was more accurately recognized than Disgust in both male and female faces in the Main Study, and recognition of Anger and Surprise were virtually identical in both the male and female sets of photographs. When broken down by age, however, the differences in level of recognition of the six emotions were significant only at ages 4, 5 and 6 for recognition of emotion in the male face.

Comparison with Table I.1 indicates that the order of difficulty identified in the present study does not agree with that found in Izard's (1971) recognition study, which was the only previous study with children using a method similar to that of the present study. Izard identified an order of difficulty of: Anger, Enjoyment, Fear, Surprise, Distress, Disgust, Shame, Interest, Contempt. However, Izard was using triads of different portrayers of the emotions throughout and it may be that differences in portrayal ability and 'recognition' by elimination of other known emotions are affecting the order of difficulty he reports. While it is recognized that in the present study some children may have attempted to identify emotions by elimination of others, it is not felt that this occurred to any appreciable degree. The children were told that photographs could be selected more than once, and instructed to leave a space if they could not select an appropriate photograph.

The Order of Difficulty of matching emotion expressions

It was hypothesized that the order of difficulty obtained for emotion matching would be different from that obtained for emotion recognition, since possibly different cognitive processes were involved in the two tasks, with emotion matching perhaps occurring by pattern recognition, and emotion recognition relying not only on ability to differentiate subtle differences but knowledge of the meaning of the differences. The order of difficulty identified in recognition and matching was different for both male and female faces.

The difference in the order of difficulties suggests that there is not a straight progression between ability to match faces on the basis of emotion expression and the ability to identify that emotion - i.e. the ability to 'extract' the relevant configuration is not a sufficient condition for that emotion to be recognized. This is

supported by the finding that female portrayals of emotion were more accurately recognized than male portrayals (though as noted above, further research would be required to ensure that in matching of female faces "hasty" errors were not being made).

The relationship between emotion recognition and emotion matching

The results clearly indicate that matching ability exceeds recognition ability, and this is particularly marked for the male face. The degree to which matching ability exceeds recognition ability varies for individual emotions.

Matching and Recognition of Happiness: Among the sub-sample of children who did both recognition and matching, Happiness is by far the most accurately recognized emotion in the male face. Happiness is the only emotion recognized more accurately in the male face than in the female face (this reflects the pattern found in the whole population of children). Thus although Happiness faces in the male and female were matched with almost equal accuracy, the sub-sample of children recognized Happiness in the female at levels lower than in the male. This supports the hypothesis of Bugental et al. (1970) that the female smile may be regarded as ambiguous by very young children, since the mother may smile even when correcting the child, resulting in the smile not being exclusively associated with Happiness.

Matching and Recognition of Disgust: Disgust was the most difficult emotion to match in the female, whereas in the male Fear and Disgust were equally the most difficult. However, in recognition of emotion only Happiness and Sadness are recognized more accurately than Disgust. In the female face Disgust is recognized (50.0%) almost as accurately as it is matched (51.8%) - the only case where this occurs. However, Happiness in the male was matched only 4.0% more accurately than it was recognized. This would, at first sight,

suggest that children have had more opportunity to learn these emotions. The early experiences with the male may be in happy circumstances, thus giving the opportunity to learn this emotion.

The greatest difference between recognition and matching ability occurred on the male portrayal of Surprise. Among the sub-sample, matching of the male Surprise face was 87.6% accurate - the level for recognition was 20.0% This supports the hypothesis that matching may occur purely on pattern recognition - possibly the Surprise photograph provides sufficiently distinctive cues to differentiate it very clearly from portrayals of the other emotions. The ability to analyse the faces and be aware of the differences (i.e. in Gibson's (1969) terms to differentiate between subtle differences), is a prerequisite to learning positively to identify the emotions.

Thus it is reasonable to speculate that faces can be matched on the basis of emotion expression by use of pattern recognition rather than any understanding of the emotion portrayed. Izard (1971) argues that recognition of an emotion is present for several years before the child can give the correct verbal label in response to being shown a portrayal of the emotion. The results obtained in the present study - especially since the superior pattern recognition involved in matching the male face was not sufficient to ensure male faces were more accurately recognized than female faces - suggests that ability to analyse the facial configuration associated with emotions may precede the ability to understand the meanings of the configurations.

THE ERRORS CHILDREN MAKE IN EMOTION MATCHING AND EMOTION RECOGNITION

The errors made by children in recognition or labelling of emotion had not been analysed by researchers such as Gates (1923) or Izard (1971). In the present study it was hoped that analysis of errors in emotion recognition and emotion matching would allow insight into the processes involved.

Comparison of errors made in emotion matching and emotion recognition

Tables IV.16, IV.18 and IV.19 indicated that errors made in emotion matching are not random, and that a pattern of common confusions can be identified as age increases.

Matching Fear with Anger, and Anger with Fear, were the two most common confusions. The Fear /Surprise confusion found in recognition of emotion did not occur very often when children matched faces on the basis of emotion expression.

The total errors made in emotion matching do not reflect those found in emotion recognition by the same sub-sample of children (Table V.1).

Table V.1: Comparison of Common Confusions in Emotion Matching and Emotion Recognition

	Female Face		Male Face	
	Recognition	Matching	Recognition	Matching
Happiness	Surprise	Anger	Fear	Anger
Disgust	Anger	Fear	Anger	Fear
Sadness	Disgust/ Anger	Disgust	Disgust/ Anger	Fear/ Disgust
Anger	Disgust	Surprise	Disgust/ Surprise	Happiness
Surprise	Fear	Anger	Fear	Anger
Fear	Surprise	Disgust	Surprise	Disgust

However, some of the errors made in emotion recognition by the 3 to 5 year olds, but not by the older groups, are the same as those made in emotion matching. Thus Anger is matched most often in error for Happiness in the female face, but is only a common recognition error among the 3 to 5 year olds; the Surprise/Anger matching confusion is a common recognition error among 3 to 5 year olds; the Happiness/Fear confusion found in matching of male faces is the most common recognition error for Happiness for 3 to 5 year olds. This suggests that for young children some inappropriate cue is identified

and judgment is based on that. The young child's tendency to pay attention to an inappropriate cue was noted by Vurpillot (1968) in his examination of children's scanning of pictures when trying to establish if two stimuli were the same or different. He suggests that scanning strategy goes through four phases - (1) the stimulus is scanned at random and the statement of same or difference is not related to the information collected; (2) sameness is deemed to be the existence of a common element, difference as absence of a common element - and the children scan just part of the stimuli; (3) same and different are defined as the adult would,but scanning lasts for only a few seconds; and (4) scanning is based on comparisons already made - i.e. areas are not re-scanned. He found that children under six made the judgment on the basis of a sample of the stimulus. Mackworth and Bruner (1970) also report children's scanning was inefficient in comparison to adults. Both studies, however, indicate how well even the six year old's scanning ability has developed.

Errors made in recognition of emotion in the whole face

Table IV.9 confirmed that the errors made by children in recognition of emotion in the whole face are not random. Examination of Table IV.9 showed that overall the confusions made in recognition of male and female portrayals of emotion were very similar: Surprise confused with Fear, Fear confused with Surprise, Anger with Disgust and Disgust with Anger. However, in the female face Surprise was the emotion most often chosen in error for Happiness, while in the male face Fear was chosen most often (and, as noted above, this was also a common matching error). Inspection of the male photographs shows that in the male Fear face, the male's teeth are showing in what Brannigan and Humphreys (1972) call the 'oblong mouth', and this may have been mistaken by the younger children for the smile. Brannigan and Humphreys have noted (p. 49-50):

> "The addition of threat is achieved by a tendency to square the mouth corners and to expose the lower teeth and to bring these teeth forward in opposition to the upper teeth. The resulting oblong smile ... may be regarded as a combination of an upper smile ... - the usual smile used in human greeting (Brannigan and Humphreys, 1969) - with oblong mouth ... (Grant, 1969) an ambivalent element seen in nursery school children who are about equally likely to flee or attack."

The errors made in recognition of female portrayals of emotion were less random than those for male portrayals, except for Sadness. Children found recognition of female portrayals of emotion easier than male portrayals - thus the errors made are more likely to be of choosing appropriate emotions in error rather than random choices.

Tables IV.11 and IV.12 showed that the number of errors made decreased with age, and that the errors became less random as age increased. However, the most popular error in some cases changes with age, suggesting that perhaps change in scanning strategy, or increased knowledge of emotions, is intervening.

Errors made in recognition of emotion in parts of the face

As can be seen from Table IV.39, the errors made in recognition of emotion in the mouths are virtually identical to those made in recognition of emotion in the whole face. In recognition of emotion in the eyes the errors are broadly similar - but with the Anger eyes being chosen most commonly in error for Happiness (whereas Surprise was the emotion most often chosen in error for recognition of Happiness in the whole female face). For recognition of emotion in noses the pattern of errors is very different from the errors in the other parts of the face and the whole face. This reflects the very difficult nature of the judgment of emotions in this part of the face.

Inspection of Table IV.38 reveals that the errors made in identifying emotions in the mouths were more systematic than those in the eyes. Identification of emotion from the mouths was easier

than from the eyes, and thus the emotions chosen in error in recognition of emotion in the mouths are of 'appropriate' rather than 'inappropriate' emotions - e.g. Fear being confused with Surprise rather than Disgust.

Tables IV.40, IV.41 and IV.42 indicate that, as with recognition of emotion in the whole face, the errors made in recognition of emotion in parts of the face become more systematic with age. The most common error changes, in some cases, from age group to age group - e.g. the youngest children chose Sadness most often in error for Disgust, whereas overall the most common error was Anger. This again illustrates how very young children may base their judgment on inappropriate cues and how, as knowledge of emotion increases, the emotions chosen in error are 'appropriate' rather than 'inappropriate'.

Comparison with common confusions identified in adult studies of emotion recognition

The errors made by children in the present study reflect the errors reported by researchers investigating the adult's ability to recognize facial emotion. Ekman, Friesen and Ellsworth (1972) analysed common confusions reported by researchers and report that only the Disgust/Anger, and Surprise/Fear/Interest confusions were found by two researchers and not contradicted by others. Tomkins and McCarter (1964) also found the Anger/Disgust and Fear/Surprise confusions (though the emotion most often confused with Surprise was Interest). Table V.2 sets out the major confusions found in the present study and those found by other researchers.

From Table V.2 it can be seen that despite the different groups of emotions being examined, and the different methodologies used, several common confusions found in the present study with children have been reported as being made by adults: Surprise/Fear,

Fear/Surprise, Sadness/Disgust, Disgust/Anger, and Anger/Disgust.

Table V.2: Comparison of Common Confusions found in present study with those reported in adult studies

	Present Study			Ekman Friesen &	
Emotion	Female	Male	Bassili (1978)	Ellsworth (1972)	Tomkins & McCarter (1964)
Happiness	Surprise	Fear	Surprise	-	-
Sadness	Disgust/ Anger	Disgust/ Anger	Disgust	-	-
Disgust	Anger	Sadness/ Anger	Fear/ Anger	Anger	Anger
Anger	Disgust	Disgust/ Fear	Disgust	Disgust	Disgust
Surprise	Fear	Fear	Fear	Fear	Interest
Fear	Surprise	Surprise	Surprise	Surprise	Surprise

Thus the Anger/Disgust and Fear/Surprise confusions predicted by the theory of Tomkins and McCarter were found in the present study. However, two other common confusions - Surprise/Fear and Disgust/Anger - are of emotions adjacent on the Woodworth-Schlosberg circle. Fear and Surprise, and Sadness and Disgust, are adjacent on the Plutchik model - though anger and fear (a common confusion in recogntion of emotion in the male face in the present study) are opposite each other and should therefore not be confused according to Plutchik. Chapter II above discussed the difficulty of comparing studies of children's ability to recognize emotion where different 'sets' of emotions were used. A similar problem arises in seeking to explain common confusions in terms of emotion theories - e.g. Tomkins and McCarter included Interest in their theory and found it to be the emotion most often confused with Surprise. Yet in experiments where Interest is not included (see Table V.2 above), Fear is the emotion most often chosen in error for Surprise. Equally Tomkins and McCarter were using labelling as the method of response, and judgments were thus of making distinctions between labels rather than between photographs.

Thus the common confusions identified in the present study reflect those found in studies with adults. The confusions are predicted by various models of emotion, but without further detailed research it is not possible to speculate if, for example, Tomkins and McCarter's explanation of why common confusions are found in studies with adults apply to children. As discussed above, examination of the common confusions in emotion recognition and emotion matching in the present study encourages the view that young children may base their judgment of emotion on insufficient or inappropriate cues.

From which part of the face do children find it easiest to recognize emotion?

On the evidence of adult studies reviewed in Chapter II it was expected recognition of some emotion would have been most accurate from the eyes. However, Happiness, Sadness, Anger, Surprise and Fear were all identified most accurately from the mouth alone. Disgust was most accurately recognized from the nose region, and thus no emotion was most accurately recognized from the eyes alone. It would, however, be premature to argue that the part of the face from which children find it easiest to recognize emotion varies from that from which adults most accurately recognize emotion. Only when subjects from 11 years old upwards had been tested using the methodology and materials of the present study could valid comparisons be made. Such a study would show whether the finding in the present study that five of the six basic emotions are most easily recognized from mouths alone is simply a reflection of the stage which children have reached in recognition ability. As children learn the more subtle cues which denote different emotions in the eyes, accuracy of recognition of emotion in the eyes may 'catch up' with that of the mouths - at least for the six basic emotions.

Inspection of Table IV.37 indicates, however, that for Fear there were only 28 more correct identifications from the mouth than from the eyes, whereas for Happiness there were 180 more correct identifications

from the mouths than from the eyes. Thus although the area from which the emotions were most accurately identified does not vary as much as expected, the accuracy levels between parts varies substantially for individual emotions.

FACTORS ASSOCIATED WITH ACCURATE RECOGNITION OF EMOTION

As noted in Chapter II, various researchers have attempted to establish what factors are linked with ability to recognize facial emotion. Just as the methodologies and sets of emotions examined varied, so too did the biographical and psychological information collected about the subjects, making analysis and comparison of results difficult. In the present study, therefore, it was decided that the relationship between ability to recognize emotion and the following basic factors would be investigated: social class, sex of subject, popularity with peers, Extraversion and Neuroticism, birth order and the presence of absence of siblings.

Emotion recognition and social class

The measure of social class in the present study was crude - the schools chosen were predominantly middle class and predominantly working class, and the children were classified accordingly. The schools were very different - not only in location but in how the children were dressed, the size of classes, and the attitudes of the teachers. In the working class school the experimenter became aware that the children were shouted at more often, were more difficult to control during testing than the middle class children, and required much more guidance and asked for more explanation of the meaning of questions during the personality testing procedure. The method of dealing with attempted copying varied dramatically between the middle class and working class school. In the middle class school the teachers generally left the experimenter alone with the class, and of the few

who asked if the experimenter minded if they remained present all but one stayed at the back of the class and did not influence the testing procedure in any way. Only in dealing with P3 did the teacher play a part in the testing and this was confined to ensuring that a group of four children who got special teaching understood the procedure. She dealt with attempted copying by shouting at the child involved, and telling him to go up to her desk and work on his own. In the working class school attempted copying was dealt with in several classes by the child being physically dragged from the desk by a teacher who had, up to that point, remained totally uninvolved in the testing procedure. Thus while the measure of social class was crude, the contrasts presented by the schools were sharp.

Recognition of emotion in the whole face

In recognition of emotion in the whole male and female face accuracy varied significantly with social class and, as predicted, middle class children performed more accurately than working class children.

When analysed by age, however, the difference between working class and middle class children's ability to recognize female portrayals of emotion was significant only at ages 3 and 4. Except at age 8, middle class children recognized female portrayals of emotion more accurately than working class children, and from Fig. IV.9 it can be seen that working class children appear to 'catch up' on recognition of female portrayals of emotion. It is possible to speculate that middle class mothers may be giving their young children early opportunities to learn about emotion expressions. This may occur through use of a more elaborate verbal code (as suggested by Bernstein, 1973), and through a greater amount of eye-to-eye contact engaged in while interacting with their children (as observed by Schmidt and Hore, 1970).

Inspection of Table IV.23 indicated that in recognition of male portrayals of emotion the class difference in ability was only significant at ages 4, 5, 6, 10 and 11. In recognition of female portrayals of emotion both social classes were performing virtually identically at 10 and 11, but in recognition of male emotion the gap between the performance of middle class children and working class children again widens. The drop in accuracy of recognition of emotion in the male by the 11 year old working class children may be due to interference by the teacher in the working class school during testing, which may have caused more errors in recognition of male rather than female emotions since, generally, children found recognition of emotions in the male more difficult.

The 'catching up' of working class children is interesting. The present study shows that working class children can, with time, perform at levels identical to those of middle class children in recognition of the six basic emotions. However, if middle class and working class children were tested on recognition of more subtle emotions (e.g. contempt) then it may be that at age 11 and above middle class children would continue to perform more accurately than working class children. The effect of class may also have been dulled in the present study by the crude measure used and by factors indirectly associated with social class (e.g. I.Q.). Izard (1971) (p. 392) reports scores on all the measures of intellectual and conceptual-motor development were associated with social class - not just emotion labelling and emotion recognition.

Recognition of emotion in parts of the face

As with recognition of emotion in the whole face, accuracy of recognition of emotion in the mouths and eyes varied significantly with social class. There was no significant class difference in recognition of emotion in noses.

Fig. IV.10 showed that the relationship between social class and ability to recognize emotions in the mouths was erratic. At age 4 the performance of both classes is not good enough to allow a significant difference to emerge, but the difference is significant at ages 5 and 6. Middle class and working class children performed virtually identically at ages 7 and 8, reflecting the convergence of accuracy rates at these ages in recognition of emotion in the whole face. The significant difference at age 9 is thus anomalous. The researcher is not aware of any disruptive element during testing which would account for this result, so it must be accepted that this was simply a chance result.

In recognition of emotion in the eyes, the class difference remained significant between the ages of 6 and 11. It is pertinent to note that there is no 'catching up' as the children approach age 11.

There was a significant interaction between age and social class for recognition of emotion in eyes, though not for recognition of emotion in any of the other sets of photographs. This may indicate that learning to recognize the subtle emotion cues in the eyes depends not just on being presented with opportunities to learn (putting middle class children at advantage), but on a certain level of cognitive development being reached (putting older middle class children at advantage).

The lack of class difference in recognition of emotion in the noses probably indicates the difficulty all children experience in making these judgments.

Emotion recognition and Sex of Subject

Contrary to prediction, it was only in recognition of emotion in the eyes that girls recognized emotion significantly more accurately than boys. Previous researchers had reported contradictory findings in emotion recognition experiments with children. Staffieri and

Bassett (1970) found girls superior in verbal labelling of male portrayals of emotion and boys superior in verbal labelling of female portrayals. However, Gitter, Mostofsky and Quincy (1970) had found no sex differences, and Dimitrovsky (1964) found girls more accurate than boys in recognition of vocally portrayed emotion. Dimitrovsky had found that boys were only superior at age 5 - and suggested that as socialization progressed, girls were encouraged to be sensitive and boys to be objective and active.

It may be that investigation of recognition of more subtle emotions (e.g. contempt) may be necessary to allow sex differences in recognition of emotion in the whole face to appear.

To fully investigate the effect of sex of subject on emotion recognition a large and carefully age balanced sample would be needed. Girls were slightly older than boys in the present study and thus maturational factors cannot be ruled out. The number (and subtlety) of emotions would also need to be increased, and the upper age limit raised to ensure that any early advantage experienced by one sex does not become evened out later on.

Recognition of emotion and popularity of subject with peers, Extraversion and Neuroticism

The measure of popularity in the present study was a simple question as to which two classmates the subject would invite if he was having a party. Children were classified as over chosen, average chosen, under chosen or not chosen. While this was sufficient for the purpose of the present study in future research a more rigorous test of popularity (i.e. over many different situations) should be applied.

The correlation between total number of emotions correctly identified in each set and popularity score was significant at the $p = 0.001$ level for the female face, the male face and for the mouths set, though only at the $p = 0.05$ level for the noses set. However,

although the correlation between popularity score and recognition of emotion in the eyes was in the direction expected it did not reach significance.

As noted in Chapter II, Buck (1975) found that children who were good 'senders' of emotion messages were extravert and had many friends at school, and in the present study it was hypothesized that recognition ability would be associated with higher scores on the E scale and with being popular. The results show that recognition ability was positively related to both E scores and popularity. (The Pearson Correlation between Extraversion and Popularity in the present study was low but significant: $r = 0.10$, $p = 0.04$).

Broken down by age, popularity was significantly related to accuracy of recognition of emotion in both the male and female face at ages 6 and 7, and for the male face only at 9 and 11.

If more subtle emotions were examined, then the superiority of children popular with their peers may continue throughout all age groups. In recognition of emotion in parts of the face, popularity was only significantly associated with accuracy at age 11 in recognition of emotion in eyes and noses, though it was significant for the whole sample for recognition of emotion in mouths and noses.

Recognition of emotion in the whole female face and in the eyes was significantly positively related to Extraversion scores, and no significant relationship was identified for Neuroticism scores. The significant relationship between Extraversion scores and recognition of emotion in the female face and eyes suggests that the extravert child may evoke more reaction/interaction from the mother, allowing it to learn about the female face and the very subtle cues to emotion in the eyes.

Emotion recognition and first/later born children and presence/absence of siblings

The hypotheses relating to birth order and presence or absence of siblings were not confirmed and, contrary to prediction, later born children recognized emotion in noses significantly more accurately than first born children (at the $p = 0.02$ level).

Having the mother exclusively to oneself does not therefore appear to assist the development of recognition of emotion. As noted above, it is recognized that factors such as the mother being involved in part-time work may affect the quantity of interaction and, of course, the quality of the interaction is also vital.

Staffieri and Bassett (1970) report that birth order did not produce significant differences in children's ability to label facial portrayals of emotion. In recent research on the effects of birth spacing, Lewis and Krietzberg (1979) report that widely and closely spaced children get more attention from the mother than middle spaced children. It may be that birth spacing is therefore more important than birth order and number of siblings. Lewis and Krietzberg admit that the reasons for birth spacing having an effect on amount of maternal care remain unclear, but they suggest it is determined both by parental attitudes and the characteristics of the infant and that it has a "reciprocal and on-going impact on the nature of social interaction in the context of the family network" (p.625). Why later born children, in the present study, should identify emotion in the noses (the most difficult set of photographs) more accurately than first born children remains unexplained - it may be, for example, that some effect of birth spacing is operating. Zajonc (1976), however, in reviewing research into factors related to I.Q. in children, argues that the more adults or older individuals there are in the immediate environment with whom the child can interact, the greater the growth in his intelligence.

It is therefore, perhaps, reasonable to argue that instead of an only child being at an advantage in having more opportunity to learn from the mother, that having a number of people with whom social interaction can take place is more important for the development of recognition of emotion. It may even be that mothers are more relaxed with second and subsequent children and thus interact with them in a more relaxed way. It is also possible to speculate that the one-child family may be different from families with two or more children - the one-child family being more controlled or constrained.

THE METHODOLOGY

The results indicate that the methodology worked very satisfactorily. The methodology developed for the present study was unique in four respects:

(1) Children were asked to select one emotion from among portrayals of six emotions: In the recognition experiments of Izard (1971), children had been asked to select one emotion from three, and in the study by Ekman and Friesen (1971), children selected one emotion from two. In the present study the level of accuracy expected by chance would be 1-in-6 - i.e. 16% - and typically performances were well above chance. At all ages the accuracy of recognition of individual emotions varied, thus indicating that it was not the child's ability to simply select one from six which was being tested, but the ability to select the specific emotions.

(2) Children were asked to identify emotion from parts of the face: Recognition of emotion in parts of the face had not previously been investigated with children. In the present study it was shown that young children can identify emotion from just part of the face. The face was simply divided into three areas, but an alternative approach would be to divide the face into anatomically independent areas as suggested by Boucher and Ekman (1975). In the present study, however,

the researcher did not have the facilities to divide the female face into anatomically independent areas, and it was vital that the same female face was used throughout to allow valid comparison of performance in recognition of emotion in the whole face with recognition of emotion in parts of the face.

(3) From 7 years old upwards recognition of emotion was tested in group form: Development of a group form of testing of emotion recognition was necessary if large numbers of children were to be tested. Inspection of the graph of accuracy of recognition of emotion in the whole face (Fig. IV.1) indicated that there was no drop in accuracy of recognition at around 7 years where group testing was introduced, though as discussed above there may have been a more subtle effect. It is, however, concluded that group testing of emotion recognition is a practicable and more economic alternative to individual testing. Further, it may reduce experimenter bias.

(4) Children were asked to match faces on the basis of emotion portrayed: In experiments such as that of Savitsky and Izard (1970), children were provided with the opportunity to pair faces on the basis of emotion portrayed (Joy, Anger, Fear and Distress), and on similarity of accessories (wearing/not wearing hats etc.). Odom and Lemond (1972) presented four of Izard's photographs, and held up a photograph which matched one of them and asked the child to select the one which was the correct match. No researcher had reported testing children's ability to match two identical sets of photographs with the six basic emotions portrayed by one actor. This, it was considered, would result in very young children being able to match faces on the basis of emotion expressions, since the information processing demands made of them would be minimized.

CONCLUSION

THE PICTURE WHICH EMERGES OF THE DEVELOPMENT OF CHILDREN'S ABILITY TO RECOGNIZE EMOTION

The picture which emerges of the development of children's ability to recognize emotion can be summarized as follows:

1. Children can match faces on the basis of emotion portrayed before they can correctly select that emotion in response to being read a short story. Thus it is reasonable to conclude that failure to recognize is not necessarily a failure to scan and analyse the configuration of the face which denotes a particular emotion.

2. Accuracy of recognition of emotion increases with age. Happiness is the emotion most accurately recognized in the male face by young children; in the female face Happiness and Sadness are recognized with almost equal accuracy by young children. Overall the order of difficulty is Happiness, Sadness, Disgust, Anger/Surprise, Fear.

3. At ages 4, 5, 6, 8 and 9 female portrayals of emotion were significantly more accurately recognized than male portrayals. This suggests that young children may have more opportunity to learn about female emotion expressions. (As discussed above, the results at age 7 may have been affected by the change to group testing.)

4. The errors children make in emotion recognition are not random and a pattern of common confusions, similar to that found in adult studies, emerges with age. Three to five year olds, however, may make errors which are not just more random than those made by older children, but which have common confusions not found in adult studies and which reflect the errors found in emotion matching. This suggests that very young children may pay attention to inappropriate cues when judging emotion, or misinterpret them.

5. Overall, middle class children recognized emotion more accurately than working class children. When broken down by age, the relationship between social class and accuracy of recognition of emotion was not consistent. However, the results obtained suggest that middle class

children are being given early opportunities to learn about emotions, and on the basis of research discussed in Chapter II it is speculated that this occurs both by the greater amount of eye-to-eye contact and the more elaborate verbal code used by middle class mothers.

6. Girls recognize the more subtle cues to emotion in the eyes significantly more accurately than boys. In recognition of emotion in the female face, the male face, the mouths and noses, girls and boys performed equally well.

7. Overall, popularity with peers was correlated significantly with accuracy of recognition of emotion in the female face, the male face, the mouths and noses. When broken down by age the pattern of correlation was not consistent.

8. The presence or absence of siblings does not significantly affect the development of the ability to recognize emotion. However, later born children (as compared to first born children) recognized emotion in noses significantly more accurately. It may be that with later born children the quality of the interaction with the mother is different, or interaction with older siblings provides greater opportunities to learn about emotion expressions.

9. Extraversion scores are significantly related to accuracy of recognition in the whole female face and eyes. Neuroticism scores are not significantly related to accuracy of recognition of emotion.

10. Children can accurately identify emotion from just part of the face, with Disgust most accurately identified from the nose and the remaining five basic emotions most accurately identified from the mouth. The errors children make in recognition of emotion in parts of the face reflect those they make in recognition of emotion in the whole face.

Accuracy of recognition of emotion varies significantly with age, social class, birth order, popularity with peers, sex and Extraversion scores. The major challenge for research now is to identify further, and explain, the within-age differences in ability to recognize

facial emotion, and this will be discussed below.

GENERALITY OF FINDINGS

The present study has thus allowed identification of the general nature of the development of children's ability to recognize emotion. However, the generality of the findings to all children must now be considered. Ekman, Friesen and Ellsworth (1972) suggest four questions must be asked about the generality of findings in the area of emotion expression and recognition.

1. Generality across eliciting circumstances and settings: Are findings in one eliciting circumstance or setting valid for another such circumstance or setting?

2. Generality across persons: Are findings general to most people (i.e. portrayers) - or only applicable if actors, or people such as extraverts, are used?

3. Generality across time: Are the findings general across time within an eliciting circumstance - i.e. is the emotion always expressed in the same way in the eliciting circumstance?

4. Generality of decoding: Could anyone make similar judgments or were the observers specially trained?

The first three questions relate to sampling emotion expressions whether posed or spontaneous. The stimulus photographs used in the present study were generated by Ekman and Friesen (1975) who instructed the portrayers to move specific facial muscles. The resulting photographs were, according to Ekman and Friesen, full portrayals of the six basic emotions. Due to the unusual method of generation of the photographs, the first three questions suggested by Ekman, Friesen and Ellsworth must be slightly rephrased.

Are the photographs (1) valid representations of expressions that could occur in other settings without the specific instructions

given by Ekman and Friesen, and (2) are they accurate portrayals of how people in general portray these emotions? Ekman and Friesen state (p. 170):

> "The models recreated the faces we had seen and studied when people were really experiencing emotions. We were in a sense drawing with a camera - not relying on imagination, as an artist might, or on the model's possible dramatic skill in trying to feel an emotion, but tracing photographically the muscular movements shown in the Facial Atlas."

It is thus reasonable to accept that the photographs generated by Ekman and Friesen do accurately portray emotions experienced and portrayed in other settings - i.e. in other laboratory settings and in everyday life.

The portrayers "followed detailed instructions based on the Facial Atlas" (p. 170). The Facial Atlas was the product of extensive research and detailed analysis of how each of the six basic emotions is portrayed in the various areas of the face. Therefore, with the reservation that in real life facial expressions of emotion may be suppressed, exaggerated, or presented as blends of several emotions, we must accept that the photographs are valid representations of how people in general portray these emotions, and that these expressions are not just produced by special groups such as actors or extraverts. There are also the results of many other researchers to indicate that emotion can be accurately judged from photographs of facial expression whether posed or spontaneous, using many different methodologies.

Precise instructions as to muscle movements, based on the Facial Atlas, were the 'pattern' used to generate the photographs. To Ekman, Friesen and Ellsworth's third question, therefore, we must answer that the expressions were repeatable within the experimental procedure.

The special methodological problems associated with testing emotion recognition in children (e.g. the need for the response to be

non-verbal, to reduce information processing demands, to reduce inappropriate cues on which emotion judgments may be erroneously based) had dictated that in the present study just one male and one female face would be presented portraying each of the six basic emotions. The validity of the methodology was discussed above. It is submitted that the photographs used were valid representations of emotions experienced and expressed by people in general in everyday life, and that the method used did allow accurate measurement of the child's ability to recognize these emotions. The children tested were a representative sample in that the schools used were typical Belfast working class and middle class schools. In answer to Ekman, Friesen and Ellsworth's fourth question, it is submitted that the findings of the present study apply to children in Northern Ireland in general since no training or selection of subjects within schools was used.

IMPLICATIONS OF PRESENT STUDY RESULTS FOR FUTURE RESEARCH

Improvements in Methodology developed in the present study

The present study has provided signposts to fruitful avenues of further research. The results obtained indicate that more detailed analyses could be performed if the methodology was improved in the following ways. It is, however, recognized that to implement all the improvements suggested would result in a time-consuming and perhaps unwieldy project.

1. Use of a more sensitive and comprehensive measure of popularity (i.e. popularity of subject over many situations).

2. Use of a more rigorous classification of social class (i.e. on the basis of father's occupation).

3. Collection of data on birth spacing of siblings.

4. Collection of data on work history, if any, of the mother when the child was of pre-school age.

5. Collection of details of parents' personality characteristics - i.e. are they 'externalizers' who readily express emotions, or 'internalizers' who hide their feelings. This would allow investigation of any possible effect of parents' personality on the child's ability to recognize emotion.

6. Addition of a cross-matching task to the matching methodology already developed. The performance of children when asked to cross-match male and female sets of photographs on the basis of emotion portrayed could then be compared to their performance on the ordinary matching task, to investigate whether the increase in information processing demanded by the cross-matching task resulted in a significant drop in accuracy.

7. Use of a sample balanced by age, sex and social class to simplify statistical analysis of the data collected.

8. For older children, investigate recognition of more subtle emotions portrayed by different actors.

Suggested areas for future research

The present research has, it is hoped, laid a sound basis for a more detailed analysis of the development of children's ability to recognize emotion. Detailed analysis of the following areas could now be attempted.

1. How do children recognize facial emotion? (a) To identify at what point recognition of an emotion is confirmed, photographs of the basic emotions could be displayed one at a time, and the child asked to say what emotion is being expressed. The eyes' scanning movements could be plotted until the emotion is identified. This would show what areas were checked and re-checked for identification of the various emotions. This, however, would rely on labelling

ability, and would thus not be suitable for use with very young children. Pairs of photographs - either identical or not identical - could also be displayed, and the eyes' scanning movements plotted until comparison was completed and the child reported the photographs were either the same or different.

(b) Ekman's Brief Affect Recognition Technique (where faces are displayed for fractions of a second in a tachistoscope) could be used to investigate how the exposure required to allow recognition to occur varies with age, and if a hierarchy of emotions is revealed as in the present study.

2. Relationship of recognition of emotion to other non-verbal communication skills: As discussed in Chapter II, children's ability to recognize vocal portrayals of emotion and also other non-verbal cues have been briefly investigated. It is important that a comprehensive picture is constructed of the development of the child's ability to exhibit and understand non-verbal communication cues. A cross-modal (visual/auditory) matching experiment would yield useful data on how a child 'puts together' cues. The child could be asked to select a photograph (from among a set of the six basic emotions) which matched a voice portraying one of those emotions. Again it would be necessary to have the same actor in all the photographs, and the same voice portraying all the emotions, to avoid matching occurring on the basis of inappropriate cues. The errors made in cross-modal matching, when compared to errors made in recognition of vocal and facial portrayals of emotion alone, would yield much information on the development of part of the range of non-verbal communication skills which the child must develop.

3. The relationship between recognition of emotion and labelling of that emotion: Does emotion recognition rely primarily on

learning of appropriate verbal labels, or is there a critical cognitive developmental process which cannot be interfered with? To investigate this an attempt could be made to coach children of various ages to recognize emotions accurately. Their performance could then be tested on another set of faces, and compared to the performance of children who did both sets without any coaching.

4. Recognition of more subtle emotions: The present study investigated the development of recognition of the six basic emotions. However, it would be premature to assume that development of recognition of all emotions proceeds in the same way. Recognition of the subtle emotions (e.g. contempt, scorn) may occur differently from recognition of the basic emotions such as Happiness. Using similar methodology, development of recognition of these emotions could also be investigated. Very young children could be asked to match faces showing these subtle emotions to further clarify how emotion matching is occurring.

The present study has begun to identify factors which play a part in the development of children's ability to recognize facial emotion. As noted above, further research can now build on the findings and methodology developed to ensure that a comprehensive picture of emotion recognition through childhood into adulthood can be obtained.

APPENDIX I

Sheet used in Pilot Study I to note responses

Subject:

Age:

Sex:

MALE FACE

Emotion to be identified	Emotion actually identified 1	2	3	4	5	6
Happiness						
Disgust						
Sadness						
Anger						
Surprise						
Fear						

FEMALE FACE

Happiness						
Disgust						
Sadness						
Anger						
Surprise						
Fear						

MATCHING

	1	2	3	4	5	6
MALE FACE						
FEMALE FACE						

(Circle Male or Female to identify which set was presented first)

APPENDIX 2

Photographs distributed in Group Test of Recognition of Emotion in the whole face

1

2

3

4

5

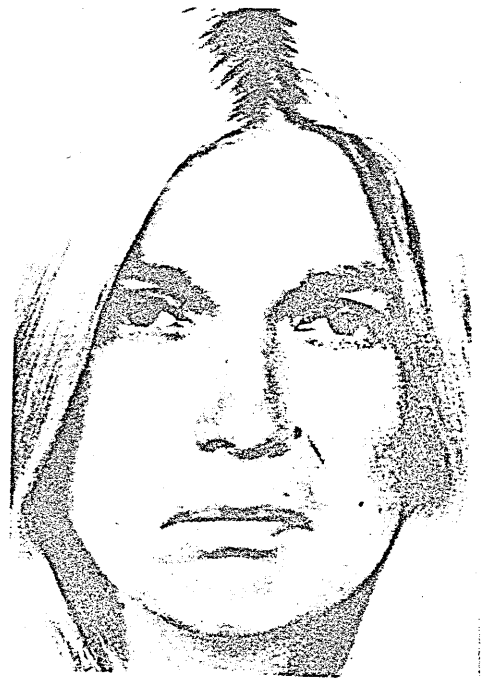
6

1

2

3

4

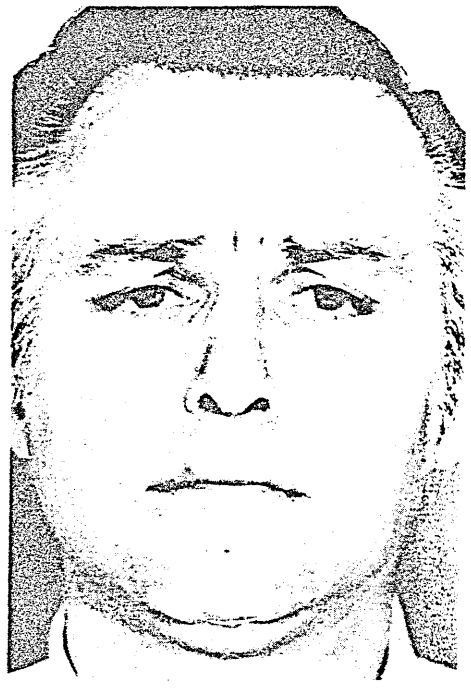


5

6

1

2



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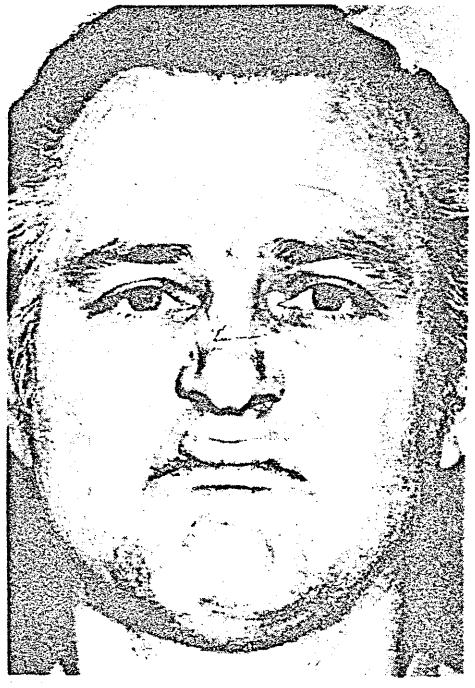

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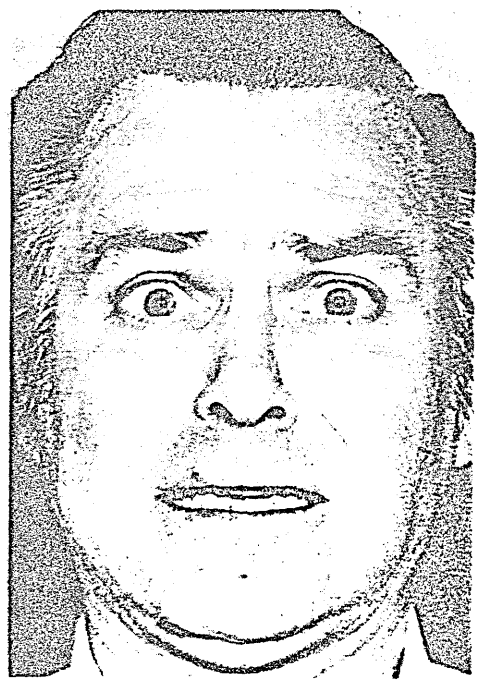

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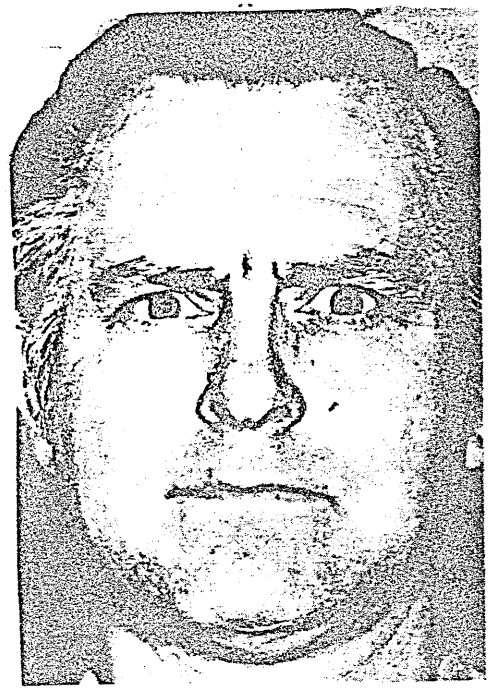


APPENDIX 3

Response sheet for recognition of emotion in the whole face

A _____

B _____

C _____

D _____

E _____

F _____

G _____

A _____

B _____

C _____

D _____

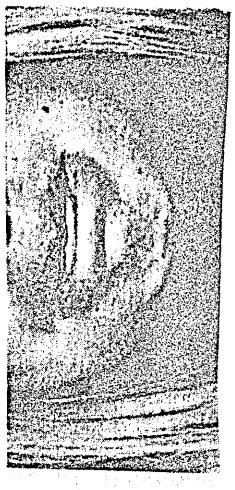
E _____

F _____

APPENDIX 4

Photographs distributed in Group Test of Recognition of Emotion in parts of the face

3



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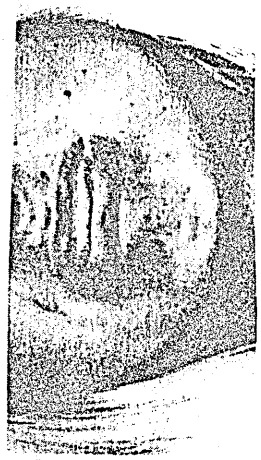

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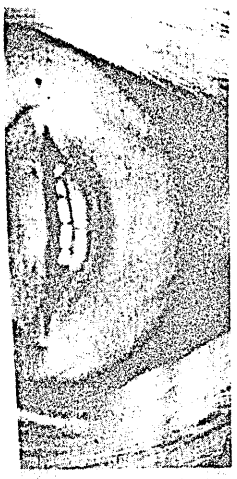

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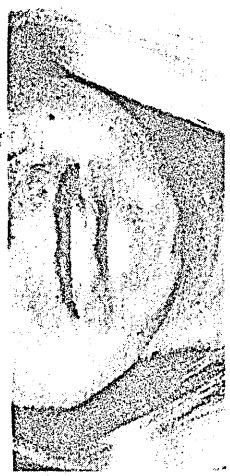

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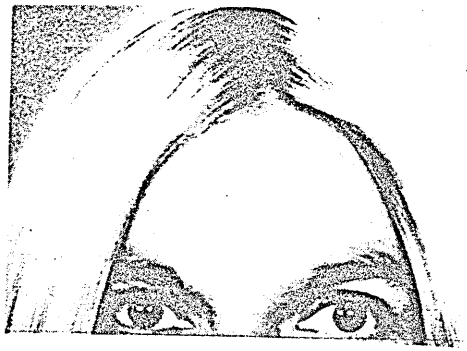

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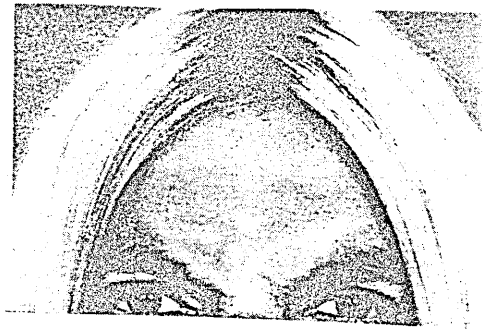

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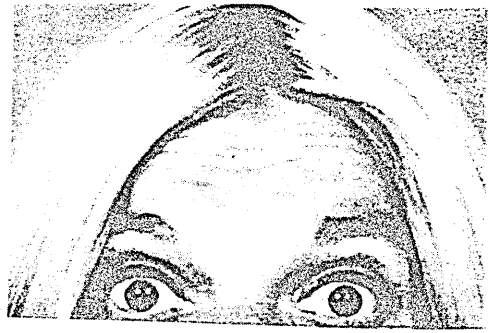

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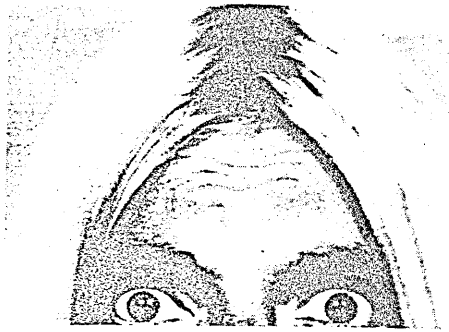

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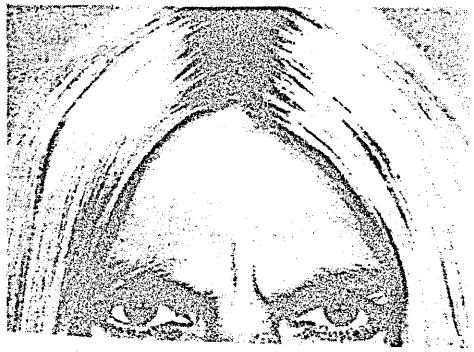

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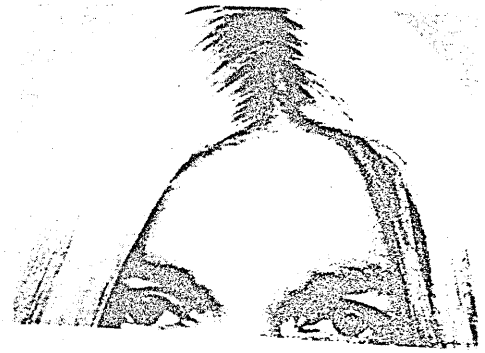

1

2

3

4

5

6

APPENDIX 5

Response sheet for recognition of emotion in parts of the face

NOSES

A _____ B _____ C _____ D _____ E _____ F _____

EYES

A _____ B _____ C _____ D _____ E _____ F _____

MOUTHS

A _____ B _____ C _____ D _____ E _____ F _____

APPENDIX 6

Additional detailed instructions used in the Main Study

1. Sequence of questions used to obtain details of siblings

Have you any brothers and sisters? How many brothers? How many of your brothers are older/bigger than you? How many of your brothers are younger/smaller than you? How many sisters do you have? How many sisters are older/bigger than you? How many sisters are younger/smaller than you?

An attempt was made to verify information given by asking e.g. did both a child's older sisters go to "big school". The information was also checked, where possible, with the teacher.

2. Introductory instructions for individual testing of recognition of emotion in eyes and noses

Eyes: "Now let's look at some eyes - these are more difficult aren't they, but just have a look and see if you can find the eyes of the lady who was happy because she was at a lovely party ... Now which might have been the eyes of the lady who was given something nasty to eat, and was disgusted? ..."

Noses: "Now here are some noses - they look funny don't they - they are harder, but just let's see if you can find the nose of the lady who was happy because she was at a lovely party ..."

3. Instructions for completion of Junior Eysenck Personality Inventory

"Now turn to the next page of your answer sheets. Up to now you have been deciding how other people were feeling. Here are some questions about how you behave and feel."

For P3 to P5 the instructions continued:

"As I read each question out I'd like you to try to decide whether your answer is 'yes' or 'no', and if your answer is 'yes' draw a circle round the 'yes' at the end of the question. If your answer is 'no', draw a circle found the 'no' at the end of the question. (Demonstrated on blackboard) We'll go through them quite quickly, but be sure not to leave any out. Please don't compare your answers with your neighour - I want to know what each one of you thinks."

For P6 and P7 these latter instructions were amended to instruct them to read each question carefully, and then work through them quickly by themselves.

4. Instructions for completion of biographical data and sociometric choices

The following instructions were given after completion of the Personality Inventory. "Now turn to the last page of your answer sheets. I'd like you to fill in some information about yourselves." In P3, P4 and P5 the instructions were given and worked through one answer at a time. In P6 and P7 the instructions were given and the children were left to complete the answers themselves.

> "Fill in your name and your date of birth in the top two spaces. I want to know how many brothers and sisters you have - so in the first space (indicated) fill in how many older brothers you have, and below that the number of younger brothers you have. Beside these there are spaces for older and younger sisters (indicated). The last thing I want to know is if you were having a party, which two people out of this class would you like to invite. Write their names down in the two spaces at the bottom of the sheet."

APPENDIX 7

Response sheet for collection of biographical data and sociometric choices

Name: _____ Boy/Girl

Date of Birth: _____

No. of older brothers _____ No. of older sisters _____

No. of younger brothers _____ No. of younger sisters _____

Names of two people in your class who you would like to invite to a party:

1. _____

2. _____

APPENDIX 8

CODING FRAME

Variable	Name	Cells
1. Case Number		1-4
2. School (Middle Class = 1, Working Class = 2)	SCH	5
3. Sex (Male = 1, Female = 2)	SEX	6
4. Age in months	AGE	7-9
5. Class: Nursery = 01 P1 = 02 P2 = 03 P2/3 = 04 P3 = 05 P3/4 = 06 P4a = 7 P4b = 8 P5 = 9 P6 = 10 P6/7 = 11 P7 = 12	CLASS	10-11
6. No. of siblings (0 = only child, then 1-n)	SIBS	12-13
7. Position in family (1-n)	POS	14-15
8. Number of older brothers (1-n)	OLDBS	16-17
9. Number of younger brothers (1-n)	YOBS	18-19
10. Twin brother	TWINB	20
11. Number of older sisters (1-n)	OLDSS	21-22
12. Number of younger sisters (1-n)	YOSS	23-24
13. Twin sister	TWINS	25
14. Sociometric choices: Overchosen = 1 Average = 2 Under = 3 Not chosen = 4	SOCM	26
15. Intactness of Family (Mother + Father = 1 Mother or Father = 2)	INTACT	27
16. Recognition of Happiness in Female Face (Right = 1, Wrong = 2)	FFH	28
17. Recognition of Disgust in Female Face (R = 1, W = 2)	FFD	29
18. Recognition of Sadness in Female Face (R = 1, W = 2)	FFS	30
19. Recognition of Anger in Female Face (R = 1, W = 2)	FFA	31
20. Recognition of Surprise in Female Face (R = 1, W = 2)	FFSP	32
21. Recognition of Fear in Female Face (R = 1, W = 2)	FFF	33

Variable	Name	Cells
22. No. of female emotions correctly identified	FEMREC	34
23. Confusion of Female Happiness (For all confusions the following applies) Happiness = 1 Disgust = 2 Sadness = 3 Anger = 4 Surprise = 5 Fear = 6 No confusion = 7 Missing = 9	FFHCON	35
24. Confusion of Female Disgust (1-7, 9)	FFDCON	36
25. Confusion of Female Sadness (1-7, 9)	FFSCON	37
26. Confusion of Female Anger	FFACON	38
27. Confusion of Female Surprise	FFSPCON	39
28. Confusion of Female Fear	FFFCON	40
29. Recognition of Happiness in Male Face (R = 1, W = 2)	MFH	41
30. Recognition of Disgust in Male Face (R = 1, W = 2)	MFD	42
31. Recognition of Sadness in Male Face (R = 1, W = 2)	MFS	43
32. Recognition of Anger in Male Face (R = 1, W = 2)	MFA	44
33. Recognition of Surprise in Male Face (R = 1, W = 2)	MFSP	45
34. Recognition of Fear in Male Face (R = 1, W = 2)	MFF	46
35. No. of male emotions correctly identified	MALEREC	47
36. Confusion of Male Happiness	MFHCON	48
37. Confusion of Male Disgust	MFDCON	49
38. Confusion of Male Sadness	MFSCON	50
39. Confusion of Male Anger	MFACON	51
40. Confusion of Male Surprise	MFSPCON	52
41. Confusion of Male Fear	MFFCON	53
42. Order (Male face first = 1 Male face second = 2)	ORDER	54
43. Recognition of Happiness in Female Mouth (1,2)	RECHFM	55
44. " Disgust "	RECDFM	56
45. " Sadness "	RECSFM	57
46. " Anger "	RECSFM	58
47. " Surprise "	RECSPFM	59
48. " Fear "	RECFFM	60
49. Total no. of mouths correctly identified	RECMOUTH	61

Variable		Name	Cells
50.	Confusion of Happiness in Female Mouth (1-7,9)	CONHFM	62
51.	" Disgust "	CONDFM	63
52.	" Sadness "	CONSFM	64
53.	" Anger "	CONAFM	65
54.	" Surprise "	CONSPFM	66
55.	" Fear "	CONFFM	67
56.	Recognition of Happiness in Female Eyes (1,2)	RECHFE	68
57.	" Disgust "	RECDFE	69
58.	" Sadness "	RECSFE	70
59.	" Anger "	RECAFE	71
60.	" Surprise "	RECSPFE	72
61.	" Fear "	RECFFE	73
62.	Total no. of eyes correctly recognized	RECEYES	74
63.	Confusion of Happiness in Female Eyes (1-7,9)	CONHFE	75
64.	" Disgust "	CONDFE	76
65.	" Sadness "	CONSFE	77
66.	" Anger "	CONAFE	78
67.	" Surprise "	CONSPFE	79
68.	" Fear "	CONFFE	80
		CASE	1-4
69.	Recognition of Happiness in Female Noses (1-7,9)	RECHFN	5
70.	" Disgust "	RECDFN	6
71.	" Sadness "	RECSFN	7
72.	" Anger "	RECAFN	8
73.	" Surprise "	RECSPFN	9
74.	" Fear "	RECFFN	10
75.	Total no. of noses correctly recognized	RECNOSE	11
76.	Confusion of Happiness in Female Noses	CONHFN	12
77.	" Disgust "	CONDFN	13
78.	" Sadness "	CONSFN	14
79.	" Anger "	CONAFN	15
80.	" Surprise "	CONSPFN	16
81.	" Fear "	CONFFN	17
82.	Matching Happiness in Female Face	MATFFH	18
83.	" Disgust "	MATFFD	19
84.	" Sadness "	MATFFS	20
85.	" Anger "	MATFFA	21
86.	" Surprise "	MATFFSP	22
87.	" Fear "	MATFFF	23

Variable	Name	Cells
88. Total no. of female faces matched correctly	FEMMAT	24
89. Confusion in matching female Happiness face (1-7,9)	CMFFH	25
90. " Disgust "	CMFFD	26
91. " Sadness "	CMFFS	27
92. " Anger "	CMFFA	28
93. " Surprise	CMFFSP	29
94. " Fear	CMFFF	30
95. Matching Happiness in Male Face (1,2)	MATMFH	31
96. " Disgust "	MATMFD	32
97. " Sadness "	MATMFS	33
98. " Anger "	MATMFA	34
99. " Surprise "	MATMFSP	35
100. " Fear "	MATMFF	36
101. Total no. of male faces matched correctly	MALEMAT	37
102. Confusion in matching male Happiness face (1-7,9)	CMMFH	38
103. " Disgust "	CMMFD	39
104. " Sadness "	CMMFS	40
105. " Anger "	CMMFA	41
106. " Surprise "	CMMFSP	42
107. " Fear "	CMMFF	43
108. E score on Junior Eysenck Personality Inventory (1-24, missing = 99)	EXTRA	44-45
109. N score on JEPI (1-24, missing = 99)	NEUROT	46-47
110. L score on JEPI (1-24, missing = 99)	LIE	48-49

FOOTNOTES

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